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Gas Matters in Yonkers, N. Y.

Elsewhere, in our present issue, will be found an article relating to gas matters in Yonkers, New York.

We congratulate the Yonkers gas company, and the citizens of that place, on the settlement of the troubles which have arisen from the introduction of opposition gas works.

The gas consumers of that place have, like many others, bought their experience and paid a high price for it. Like the communists, who expect to compel the capitalist to pay them their own price, whether it pays him or not, they thought they could compel the old company to supply them with gas below the cost price.

A ready and willing agent was at hand with a *patent process* for making illuminating gas from wind, and other materials, which would be of the very best quality. After a sufficient number of victims had been trapped by the patent bait, the works were erected, at great expense, and in the very worst location that could possibly have been selected.

The scheme failed at last, as it has in many other places before, and the man with his *patent process* is now most likely showing the great advantages of his way of making gas in other places where the people are innocent enough to listen to him.

Then another set of speculators arrive, who buy out the demoralized works, not with their own money, but with that of a capitalist who was drawn into their net. In due time he is well plucked, and thoroughly disgusted with all kinds of gas, whether made from coal, naphtha, air, water or cheek.

Then came the usual cutting of prices, to a point that neither company could stand for any length of time; the consumers meanwhile looking smilingly on in happy ignorance of the facts that the loss must be made good to the survivor after the conflict.

The rival companies have now come to an agreement, and the price of gas has been put up to a paying point.

Now see the fallacy of opposition gas companies particularly in small cities.

The Yonkers gas-light company's works were large enough to supply double the amount of gas required by the people, at the time the opposition gas company came on to the ground, and yet the people of Yonkers thought that by building another works, laying another set of mains, and supporting another office, they would get their gas much cheaper. The price of gas would have been reduced in accordance with the times, had there been no opposition. Now the interest on the cost of the opposition works, mains, etc., has to be paid in addition.

It has been found in every city where opposition works have been introduced, that the people have seldom been benefitted thereby. Either the district to be lighted is divided, or the weaker company fails—in either case the price of gas is not lowered, and somebody loses by the operation.

New York and Brooklyn have three times as many gas works as are actually required, and consequently, gas cannot be sold as low as it might have been, under other circumstances.

In almost every case, where an opposition gas company is started, the gas is to be made from some other substance than coal, and "patent process," "cheapness," and "illuminating power" are the charmed words which are used to raise the wind.

To a person long connected with the manufacture of coal gas, it seems as if these "mysterious processes" for making gas have their regular periods of appearance and disappearance, sometimes the same agent appearing many times with the same "process," but "very much improved," the one little thing lacking that made a failure of it before has been at last discovered, and it is now all right; if you don't believe it here is Prof. X's analysis of the gas, and description of the process, etc.

Perhaps the time will come when gas can be made cheaper from wind, or, water, or something else; but it is hoped that the discovery will be made and introduced by some of our regular engineers, rather than by any of the hungry adventurers who are to the gas companies what the grasshoppers are to the farmers in the West.

Fatal Gas Explosion in Brooklyn, N. Y.

An explosion of gas, attended with fatal results, occurred in the new Municipal Department building, which is located in Joralemon street near Fulton, in the city of Brooklyn, on Monday morning, June 24th.

The facts in the case (which were kindly furnished us by Hamilton Reeve, Jr., chief clerk in the Bureau of Collection, City Tax Department) are as follows:

Near the centre of the building, on the ground floor, are located the above-mentioned offices. For the safe-keeping of the books and papers be-

longing to the tax office, an air-tight and fireproof brick vault or safe, 18 feet in height by 6 feet in width, was erected. This vault, it appears, was lighted by two three feet burners. From the statement made by the plumber, who was engaged in making some repairs to the pipes, etc., on Saturday afternoon, it seems that the gas was turned off at the meter before the lights in the vault were extinguished. When the repairs were completed, the gas was again turned on, at the request of the Police Commissioners, who occupy offices in the same building. The burner cocks in the vault described above not having been shut off, the gas escaped into the safe, and its accidental ignition caused the fatal results which followed.

The stamp clerk, Mr. W. F. Code, who has charge of the vault, inspected it before leaving on Saturday afternoon, and found everything apparently all right.

At 9 20, A. M., on Monday morning (June 24th) a tax searcher, Mr. Oliver S. Vincent, requested admittance to the vault to examine an old cash book. Having obtained permission, Mr. Vincent accompanied by Mr. Code entered the safe. It being rather dark Code ignited a match, when both were instantly enveloped in a sheet of flame, followed immediately by a loud explosion.

The shock was so great that Mr. Vincent was hurled from the safe, and thrown with great violence against a desk casing opposite. The injuries which he received resulted in death some hours later.

Mr. Code fortunately escaped fatal injury, but received a severe shock to his nervous system, and was badly burned about the face and head.

Our reporter, while talking to Mr. Reeve, who was standing in close proximity to the vault at the time of the explosion, noticed that his hair (Mr. Reeve's) was badly singed, and a silk hat which he had on at the time was badly scorched.

The walls of the vault, which were strongly built brick ones, were completely demolished, as also a great quantity of the furniture, sashes, etc., belonging to the offices located in the west side of the building.

The amount of damage done will probably not exceed $1,500.

On the Action of Sonorous Vibrations in Varying the Force of an Electric Current.

By Professor HUGHES.

[A Paper read before the Royal Society, May 9th, 1878.]

The introduction of the telephone has tended to develop our knowledge of accoustics with great rapidity. It offers to us an instrument of great delicacy for further research into the mysteries of accoustic phenomena. It detects the presence of currents of electricity that have hitherto only been suspected, and it shows variations in the strengths of currents which no other instrument has ever indicated.

It has led me to investigate the effect of sonorous vibrations upon the electrical behavior of matter. Willoughby Smith has shown that the resistance of selenium is affected by light, and Bornstein has led us to believe that many other bodies are similarly affected. We know also that the resistance of all bodies is materially influenced by heat. Sir William Thompson and others have shown that the resistance to the passage of currents offered by wires is affected by their being placed under strains, and, inasmuch as the conveyance of sonorous vibrations induces rapid variations in the strains at different parts of a wire, I believed that the wire would vary in its resistance when it was used to convey sound. To investigate this I made a rough-and-ready telephone, with a small bar-magnet 4 inches long, half the coil of an ordinary electro-magnet, and a square piece of ferrotype iron 3 inches square, clamped rigidly in front of one pole of the magnet between two pieces of board. When using the pendulum beats of a small French clock, or the voice, as a source of sound, I found this arrangement supplied me with an extremely delicate *phonoscope* or sound detector.

All the experiments detailed in this paper were made with the simplest possible means, and no apparatus of any kind constructed by a scientific instrument maker was employed. The battery was a simple Daniell's cell, of Minotto's form, made by using three common tumblers, a spiral piece of copper wire being placed at the bottom of each glass and covered with sulphate of copper, and the glass being then filled with well moistened clay and water. A piece of zinc as the positive element was placed upon the clay. Insulated wires were attached to each plate, and three of these cells were joined in series. All experiments were made on a closed circuit, the telephone being used as a phonoscope to detect variations in the current and the consequent reproduction of sound. The apparatus, or materials experimented upon, were used in the same way as the transmitter of the speaking telephone of Bell.

I introduced into the circuit a strained conductor—a stretched wire—listening attentively with the telephone to detect any change that might occur when the wire was spoken to or set into transverse vibrations by being plucked aside. Gradually, till the wire broke, the strain was varied, but no effect whatever was remarked except at the moment when the wire broke. The effect was but momentary, but invariably at the moment of breaking a peculiar "rush" or sound was heard. I then sought to imitate the condition of the wire at the moment of rupture by replacing the broken ends and pressing them together with a constant and varying force by the application of weights. It was found that if the broken ends rested upon another with a slight pressure of not more than one ounce to the square inch on the joints, sounds were distinctly reproduced, although the effects were very imperfect.

It was soon found that it was not all necessary to join two wires endwise together to reproduce sound, but that any portion of an electric conductor would do so even when fastened to a board or to a table, and no matter how complicated the structure upon this board, or the materials used as a conductor, provided one or two portions of the electrical conductor were separated, and only brought into contact by a slight but constant pressure. Thus, if the ends of a wire terminate in two common nails laid side by side, and are separated from each other by a slight space, were electrically connected by laying a similar nail between them, sound could be reproduced. The effect was improved by building up the nails log-hut fashion, into a square configuration, using ten or twenty nails. A piece of steel watch-chain acted well. Up to this point the sound or grosser vibrations were alone produced, the finer inflections were missing, or, in other words, the *timbre* of the voice was wanting, but in the following experiments the *timbre* became more and more perfect until it reached a perfection leaving nothing to be desired. I found that a metallic powder such as the white powder—a mixture of zinc and tin—sold in commerce as "white bronze," and fine metallic filings, introduced at the point of contact, greatly added to the perfection of the result.

At this point articulate speech became clearly and distinctly reproduced, together with its *timbre*, and I found that all that now remained was to discover the best material and form to give to this arrangement its maximum effect. Although I tried all forms of pressure and modes of contact—a lever, a spring, pressure in a glass tube sealed up while under the influence of strain, so as to maintain the pressure constant, all gave similar and invariable results, but the results varied with the materials used. All metals, however, could be made to produce identical results, provided the division of the metals was small enough, and that the material used does not oxidise by contact with the air filtering through the mass. Thus platinum and mercury are very excellent and unvarying in their results, whilst lead soon becomes of such high resistance through oxidisation upon the surface as to be of little or no use. A mass of bright round shot is peculiarly sensitive to sound whilst clean, but as the shot soon become coated with oxide this sensitiveness ceases. Carbon, again, from its surface being entirely free from oxidation, is excellent, but the best results I have been able to obtain at present have been from mercury in a finely-divided state. I took a comparatively porous non-conductor, such as the willow charcoal used by artists for sketching, heating it gradually to a white heat and then suddenly plunging it in mercury. The vacua in the pores, caused by the sudden cooling, became filled with innumerable minute globules of mercury, thus, as it were, holding the mercury in a fine state of division. I have also tried carbon treated in a similar manner with and without platinum deposited upon it from the chloride of platinum. I have also found similar effects from the willow charcoal heated in an iron vessel to a white heat, and containing a free portion of tin, zinc, or other easily vaporised metal. Under such conditions the willow carbon will be found to be metallised, having the metal distributed throughout its pores in a fine state of division. Iron also seems to enter the pores if heated to a white heat without being chemically combined with the carbon as a graphite, and, indeed, some of the best results have been obtained from willow charcoal containing iron in a fine state of division.

Pine charcoal treated in this manner (although a non-conductor as a simple charcoal) has high conductive powers, due to the iron; and from the minute divsiion of the iron in the pores, is a most excellent material for the purpose.

Any one of these precautions confined in a glass tube or a box, and provided with wires for insertion in a circuit I call a "transmitter."

Reis, in 1860, showed how, by the movement of a diaphragm, intermittent voltaic currents could be transmitted, agreeing in exact number with the sonorous waves impinging on the diaphragm, and thus reproducing music at a distance by causing an electro-magnet to vibrate in unison with the diaphragm; and, with an iron diaphragm Graham Bell showed how the vibrations of that diaphragm in front of a polarised electro-magnet could similarly induce magneto-currents, corresponding in number, amplitude, and form, with the sonorous vibration, and thus reproduce all the delicacies of the human voice. Edison and others have produced variations in the strength of a constant current by causing the diaphragm to press directly upon some elastic conductor, such as carbon, spongy platinum, etc., the varying pressure upon these materials varying the resistance of the circuit, and consequently the strength of current flowing. Graham Bell and others have

produced the same effect, by causing the vibrations of the diaphragm to vary the electromotive force in the circuit. It will be seen, however, that in the experiments made by myself, the diaphragm has been altogether discarded, resting as it does upon the changes produced by molecular action, and that the variations in the strengths of the currents flowing are produced simply and solely by the direct effect of the sonorous vibrations.

I have found that any sound, however feeble, produces vibrations which can be taken up by the matter interposed in the electrical circuit. Sounds absolutely inaudible to the human ear affect the resistance of the conductors described above. In practice, the effect is so sensitive that a slight touch on the board, by the finger nail, on which the transmitter is placed, or a mere touch with the soft part of a feather, would be distinctly heard at the receiving station. The movement of the softest camel hair-brush on any part of the board is distinctly audible. If held in the hand several feet from a piano the whole chords—the highest as well as the lowest—can be distinctly heard at a distance. If one person sings a song, the distant station, provided with a similar transmitter, can sing and speak at the same time, and the sounds will be received loud enough for the person singing to follow the second speech or song sent from the distant end.

Acting on these facts, I have also devised an instrument suitable for magnifying weak sounds, which I call a microphone. The microphone, in its present form, consists simply of a lozenge-shaped piece of gas-carbon, one inch long, quarter inch wide at its centre, and one-eighth of an inch in thickness. The lower pointed end rests as a pivot upon a small block of similar carbon; the upper end being made round plays free in a hole in a small carbon-block, similar to that at the lower end. The lozenge stands vertically upon its lower support. The whole of the gas carbon is tempered in mercury, in the way previously described, though this is not absolutely necessary. The form of the lozenge-shaped carbon is not of importance, provided the weight of this upright contact is only just sufficient to make a feeble contact by its own weight. Carbon is used in preference to any other material, as its surface does not oxidise. A platinum surface in a finely divided state is equal, if not superior, to the mercurised carbon, but more difficult and costly to construct. I have also made very sensitive ones entirely of iron.

The best form and materials for this instrument, however, have not yet been fully experimented upon. Still, in its present shape, it is capable of directing very faint sounds made in its presence. If a pin, for instance, be laid upon or taken off a table, a distinct sound is emitted, or, if a fly be confined under a table glass, we can hear the fly walking, with a peculiar tramp of his own. The beating of a pulse, the tick of a watch, the tramp of a fly, can thus be heard at least a hundred miles distant from the source of sound. In fact, when further developed by study, we may fairly look for it to do for us, with regard to faint sounds, what the microscope does with matter too small for human vision.

It is quite evident that these effects are due to a difference of pressure at the different points of contact, and that they are dependent for the perfection of action upon the number of these points of contact. Moreover, they are not dependent upon any apparent difference in the bodies in contact, but the same body in a state of minute subdivision is equally effective. Electrical resistance is a function of the mass of the conductor, but sonorous conduction is a function of the molecules of matter. How is it, therefore, that a sonorous wave can so affect the mass of a conductor as to influence its electrical resistance? If we assume a line of molecules, we know that a sonorous wave is accompanied by alternate compressions and rarefactions. If we isolate the part under compression from the part under dilation we cary the dimensions of the mass, and we alter its electrical resistance. In any homogeneous conductor of finite dimensions the effect of the one will exactly compensate for the effect of the other, and we get no variation of current, but if we break up this homogeneous conductor into a series of minute subdivisions, without actually breaking their electrical continuity, we destroy its neutralising influence, and we render evident the effect of sonorous vibrations in varying the dimensions of the mass of the conductor, and therefore in varying its electrical resistance, for we reduce the length of a portion of the conductor to a fraction of the length of a sonorous wave. Molecular action alone explains to me all the effects produced. Size or shape does not affect them. A piece of willow charcoal the size of a pin's head is quite sufficient to reproduce articulate speech. I regard the action as follows:

If we have two separate conductors joined simply by contact, this contact offers a certain resistance. Now we can vary or lessen the resistance by increasing the pressure, thus bringing more points in contact or closer proximity. Now, as I employ a constant pressure on the contact, which is exactly under the same influence of the vibrations as the points of contact, more points or closer proximity can only be obtained through the molecular swelling or movement of the contact points.

The tube transmitter, which I exhibit this evening, consists of an exterior glass tube two inches long, and one quarter of an inch in diameter. In it are four separate pieces of willow charcoal, each one quarter of an inch long, and two terminals of the same material. The terminals are fastened in the tube, and connect exteriorly with the line and interiorly with the four loose pieces.

The instant the sonorous vibrations pass in the tube there is electric contact to a remarkable degree, which could only have taken place by the molecules enlarging their sphere under the influence of the sonorous vibrations.

It is impossible to say what can be the applications or effects of the discovery which I have had the honor of bringing before the Royal Society, for the whole question has been studied with crude materials, and scarcely sufficient time has elapsed to enable me to consider its ultimate uses. I do not desire to assert that there is anything in what I have brought forward that is superior to or equal to other transmitters used for telephony. It is as loud and far more sensitive than any I have yet heard, and it may be increased by multiplication of transmitting contacts in quantity or intensity; the loudness is at present limited by the capability of the receiver. The materials at my disposal, and the arrangement of them, have not yet been sufficiently studied. I only wished to show that it is possible to transmit clear and intelligent articulate speech, and to render audible sounds which have hitherto been inaudible by the mere operation of sonorous vibrations upon the conducting power of matter.

My warmest thanks are due to Mr. W. H. Preece, electrician to the Post Office, for his appreciation of the importance of the facts I have stated, and for his kind counsel and aid in the preparation of this paper.

I do not intend to take out a patent, as the facts I have mentioned belong more to the domain of discovery than invention. No doubt inventors will ere long improve on the form and materials employed. I have already my reward in being allowed to submit my researches to the Royal Society.—*Chemical News.*

Illumination by Electricity.

By J. Jamin, de l'Academie des Sciences.

[Condensed from the *Revue des Deux Mondes*, of Mar. 15th, 1878, by Dr. William H. Greene.]

The Gramme machine, as the electric source, and the Jablochkof candle have made the application of electricity to purposes of illumination, a fact beyond doubt.

The intensity of the moon's light is inferior to that of a candle, and incomparably more feeble than that of the sun.

The comparison of the electric arc to the sun, which is our highest conception of brilliancy, may be made in two ways; by the relative times required to produce equal photographic images, or by the direct measure of the illluminating powers. Fizeau and Foucault found by the first process that the power of the sun is only two and a half times superior to that of the arc; the second method has proved that the carbon points with a powerful machine are equal to the sun in lustre. It is even probable that this limit may be passed, and it is not strange, if it be remembered that our sun does not occupy the first position in the universe. It is a star already old, the cooling of which is considerably advanced and whose yellowish light begins to approach that of terrestrial flames.

In quantity and quality, the electric light greatly exceeds all flames, and in brilliancy it approaches or even surpasses the sun. It is precisely this immense profusion of illuminating power that is urged against the electric light. It is said to be exaggerated, to exceed our requirements, that it ought to be divided, but it is indivisible.

It is true that the electric light is dangerous, like that of the sun; we may be illuminated by it, we should not look at it. But is it by any means certain that it cannot be divided or so reduced in lustre as to be rendered tolerable?

Nothing is easier than to reduce its lustre to any degree that may be desired; it is only necessary to cover the arc with a large opalescent globe. The latter hides it, receives all of the rays and dispenses them precisely as if the globe itself were luminous. It replaces the original source, at the same time increasing the dimensions, and if it be ten thousand times larger, it reduces the lustre to the ten thousandth part. It is true, this process absorbs and wastes a notable portion of the light emitted, but where the electric light can be adopted, this is of but little importance. The division of the arc can easily be accomplished by the use of the alternative currents long since devised by Le Roux, for when the alternations succeed each other at intervals of one twenty-fifth of a second, the extinction ceases to be perceptible, and the effect is that of a continuous light. The Jablochkof candle, when the thickness and distance of the two carbons are diminished, permits a still further division, so that each candle may equal but fifty Carcel lamps, and a number of these candles may be placed in the same circuit.

The division may be carried still further, as shown by a new and remarkable experiment of M. Jablochkof's. He prepares an immense condenser composed of two tinfoil surfaces, separated by oiled silk, and folded as the condenser of a

Ruhmkorff coil. The surfaces are connected with the two rheophores of an alternating current machine, so that a large space is presented on which the electricity may accumulate and condense until the direction of the current changing, each disappears to be replaced by the opposite electricity, which, in its turn, undergoes the same condensation. It is evident that these conditions should greatly modify the electric circulation in the wires, and experiment confirms the assertion. When the current is broken, brilliant sparks are produced, flashing like fire, and enveloped in a very luminous yellow flame, at the same time accompanied by a sonorous humming sound, of the same pitch as the noise of the machine, which proves that the periodic intervals of the production of the sparks are the same as those of the formation of the currents. This experiment leads to one practical result; it is that by introducing a condenser into the circuit, the number of candles that the latter is capable of sustaining is doubled, but the light of each candle is, of course, reduced one-half. All is reduced to a greater division of the illumination. It is not desirable to go beyond this point, for the Jablochkof candle, with the condenser, gives a light equal to 25 Carcel lamps, and, in order that electricity may be adopted as a source of light, its power must be equal to that of at least twenty Carcel lamps.

M. Jablochkof made another interesting experiment; he passed the alternating current through the interior wire of a Ruhmkorff coil, producing in the exterior wire induced currents also alternating, but of greater intensity, which are capable of diffusing upon the edge of a thin piece of kaolin, illuminating it, and maintaining the incandescence as long as may be desired. It is a beautiful physical experiment, but its practical application is doubtful.

The light of a gas-flame is orange yellow when compared to that of the electric light. That a light may be applicable for purposes of illumination, it is necessary that it shall contain the seven primitive colors of the spectrum in certain proportions. All luminous bodies do not contain these colors in the same proportions. The electric arc produced between silver and carbon, contains only two green bands, and if the silver be replaced by other metals, the spectrum obtained is always formed of brilliant lines separated by wide, dark spaces. These lights are very incomplete, and would not, in any case, be used for illumination.

The spectrum of gas and oil flames are continuous; the red, orange and yellow are very abundant; there is but little green, almost no blue, and little or no violet. These flames are rich in colors but slightly refrangible, which gives them their orange tint, poor in highly refrangible rays and destitute of indigo and violet. That of which they possess too much, the red, may be removed, but it is impossible to add to them the indigo and violet which they lack, and this is the cause of their inferiority. The electric light is more complex; it proceeds at the same time from the carbons and from the arc, and differs according to the one or the other of the sources. That from the carbons is white; it is absolutely the same as that of the sun, and contains all of the simple rays in the same proportions. It is complete and perfect and replaces daylight without any modification. It is not the same with the light from the arc itself; it is violet blue, and its spectrum tends altogether towards the most refrangible colors; it is the opposite of gas or lamp-light; it contains little red, much blue, and a large excess of violet. It is this light of the arc which gives to electric illumination the bluish tint which has been objected to with reason. But it is a fault of excess which can be remedied, for while the missing rays cannot be added to gas-light, the superfluous rays can be removed from the electric light. The eye receives the vibrations of the ether which constitute the light, just as the ear receives sounds transmitted by the air, and ceases to be conscious when the vibrations become so rapid or too slow, just as the ear ceases to hear notes too acute or too grave. But such extreme vibrations exist; there are rays below the red and beyond the violet, both of which are imperceptible to our eyes. The first are the heat rays, so abundant in the spectre of the flames, the second exist in large proportion in the light of the arc, and are those which it is important to recognize and remove. Their existence may be proved in two ways, first by receiving the spectrum upon a photographically sensitive surface. The image formed in the red is very feeble, while those formed as the violet is approached become better and better; but the action does not stop at the violet. The photographic intensity is extended and increases beyond the violet, which proves the existence of ultra-violet rays of rapid vibration which our eyes cannot recognize, but which are eminently fitted for photographic action. The second method is different. If a solution of quinine sulphate be spread with a small brush upon the spectrum from the red to the violet, no effect is perceived in the red, but after the blue a whitish tint marks the path of the brush, and this is increased and becomes most brilliant in the rays which are beyond the violet. The quinine sulphate has, therefore, the property of changing the blue, violet and ultra-violet rays into white light, and, at the same time, it renders visible and useful, radiations which the eye could not perceive, and adds them to the available light.

Uranium glass and many other substances act in the same manner and present the means of suppressing the rays which are objectionable in the electric light. This suppression is necessary in other respects. These rays are said to attack the humors of the eye, and to be the origin of grave diseases.

But the electric light has its faults, one especially which will exclude it from many places. It produces a grave continuous note like the buzzing of a swarm of flies or an æolian harp. It is not a disagreeable note, but it becomes monotonous. It is produced by the succession of alternate currents lighting and extinguishing the arc at each change of direction, with a little noise each time. As this noise is produced at equal intervals, it becomes a tone, the same as that produced by the machine, and when the candles are placed in globes, the latter become resonators, and increase the sound. The Gramme machine is the only one which furnishes a silent light, because its current is continuous in the same direction.* The electric light, however, does not vitiate the atmosphere, and produces very little heat.

In ordinary flames, the production of light is a secondary phenomenon which accompanies the chemical combination of the combustible with the oxygen of the air. This combination is doubly objectionable, removing the oxygen from the air, and replacing it by vapor of water and carbonic acid gas. The latter, although not as dangerous as has been believed, has not a good reputation, and the best that can be said in its favor is that it does not kill. The electric light has the decided advantage of not altering the respirable medium. Chemical combination has still another inconvenience; with the light it develops such an amount of heat as sometimes to render workrooms almost uninhabitable.

On the contrary, the electric arc does not heat. This appears astonishing at first, for all bodies fuse or volatilize when introduced into the arc; but if a very sensitive thermometer be placed in the spectrum of the electric light, it is found that there is no indication of heat in the violet rays; that in the green the thermometer begins to be heated, and that the temperature continues to rise as the red is approached, and attains a maximum in the obscure rays beyond the red. Now these heat-producing rays are by far the more abundant in gas and lamp flames, while the arc, which is the best test of luminous sources, emits the greatest amount of light with the least proportion of heat.

The exact cost of the electric light is yet a matter of question, but the Lontin Company furnish all of the apparatus, wires, lamps, etc., of which it retains the ownership, and demands fifty centimes an hour for a quantity of electricity, equal to 100 gas jets, on the condition of a guarantee of the use of a certain amount of light for a certain number of years. One of the proprietors of the magasins du Louvre has authorized the statement that the apparatus of the Denayrouse-Jablochkof Company, in their use, gives more light than gas with 30 per cent. less cost.

The fault has often been committed of attempting street illumination on the light-house system by a beam of light concentrated by reflectors, and thrown along the length of the street. Such experiments have only succeeded in blinding the by-passers and projecting behind them long shadows as black as open precipices. There are cases when such concentration is the only end that is desired. In workshops it is only necessary that the workmen shall have a clear view of the work before them. It is the same in dining-rooms, billiard halls, reading-rooms, etc., and no one pays attention to the obscurity behind him.

It is different in depots, theatres, lecture rooms and display store rooms; in these cases a general illumination is required, coming from all directions, and lighting every side of an object.

When several electric lights are placed in a hall illuminated by gas, the eye immediately experiences a sort of relief, both by the redoubled brilliancy and by the perception of colors which were not before suspected; and, on the contrary, if the electric lights be suddenly extinguished, the spectators are thrown into the comparative night of the old illumination.

The conditions of good electrical lighting must be determined by a study of the general illumination of objects during the day. When the sky is clouded, the sunlight pierces the clouds as through a ground glass, and the whole sky is like an immense illuminated ceiling, radiating light from every point and in all directions. The objects illuminated diffuse in their turn the light which they receive, so that there is an inter-crossing of rays, producing the effect of a mean amount of light everywhere; this is general illumination.

Such is the model that must be followed. For this purpose the ceilings, walls and floors must be well illuminated, that the diffused light may be radiated into the empty spaces; and, that the quantity may be the same everywhere, it will be also necessary to multiply the sources of light. That the direct rays may not painfully affect the retina, it will also be necessary to diminish their brilliancy by the interposition of ground glass and some florescent substance, such as quinine

* In the experiments made by the Committee of the Franklin Institute, it was found that all of the so called continuous current machines produced some sound in the arc.—J. B. K.

sulphate, in order to transform the violet and ultra violet rays into white light. Lastly, and especially, it will be necessary to cover all openings by which the light may escape.

The exterior light enters by the windows during the day, and it is by them that the nocturnal illumination escapes. M. Jablochkof introduced electric lighting into the laboratory of the Sorbonne, and the feeble effect it produced was astonishing. This laboratory is covered with a glass roof, by which it is well lighted during the day, and by which it allowed the loss of at least one-half of the light produced by the electric candles. This wasted light illuminated the high walls of the surrounding buildings, and gave a brilliant but useless illumination in the court. A similar occurrence took place last summer on the occasion of an experiment attempted in the Palais de l'Industrie. All of the light had been concentrated in six lamps, far from each other; this was the first fault which would have been avoided by distributing a large number of less powerful lamps throughout the immense building. Lastly all of this light, instead of being directed towards the spectators by a well-combined system of diffusion, escaped through the vast glass roof, to be uselessly lost in the heavens. The experiment would have succeeded had the roof been covered with a thick white covering, destined to reflect back the light so prodigally wasted.

The same thing happens with gas, and will occur with electricity in the illumination of public places. All of the lamps waste half of their light in radiation towards the sky. A simple reflector would return it to the ground and double the illumination.—*Jour. Fraklin Inst.*

[Since the above article was put in type, we have received the complete text of M. Jamin's lecture, which we think to be of sufficient importance to lay before our readers in full.—Ed.]

[From the London Journal of Gas-Lighting.]

Lighting by Electricity.

[Translated from the 'Journal des Usines a Gaz."]

We give to-day, from the *Bulletin de l'Association Scientifique de France*, a *resume* of the lecture delivered at Sorbonne, on the 9th of February last, on the subject of the Electric Light, by M. Jamin, Member of the Institute, and Professor at the Polytechnic School and at the Faculty of Sciences, adding at its conclusion, a few observations of our own. We shall not speak of the formation of the *Compagnie Parisienne d'Eclairage par l'Electrtcite*, as the controversy on this subject would fill our columns. It is, however, interesting in more than one respect, and we strongly advise gas shareholders to make themselves acquainted with it through the medium of the financial papers. We have no doubt whatever that they will keep their money in their pockets.

M. Jamin's lecture was as follows:

Forty years after the discovery made by Volta about the year 1813, one of the most illustrious of English chemists, Sir Humphrey Davy, performed a memorable experiment. He took two red-hot carbons, which he extinguished in mercury, pointed them, and, having fixed them to the *rheophores* of a pile, placed them in contact. The points became heated to a red heat; he then drew them apart, and saw produced between them a slightly convex flame, which he called the *electric arc*. It possessed a brilliancy comparable to that of the sun, and its temperature was so high that platinum melted in it like wax. This arc could be produced in a vacuum as well as in the air, its size could be increased to 10 centimetres (4 inches) by drawing back the conductors, after which it went out, and could not be relighted, except by again putting the carbons in contact.

This magnificent experiment necessitated a very large pile; besides, Davy not thinking of making it the principle of a new system of lighting, this idea was not conceived and realized until considerable progress had been made in the art of producing electricity. Sufficient advancement has been made, however, by this time to allow the electric lamp to take, in point of economy, the first place in lighting on a large scale. The hall in which we are assembled is illuminated by 14 electrical focuses, equal altogether to 1,400 Carcel burners. I venture to assert, and you will not contradict me, that never was there illumination more beautiful, more inoffensive, more agreeable to the eyes, and more favorable for colors. It is supplied to us gratuitously by two companies—that of MM. Denayrouze and Jablochkoff, and that of M. Lontin, rivals before the public, and rivals also in the eagerness they have displayed to appear before us. Let me first of all, in my own name as well as in yours, offer them our thanks; I shall afterwards explain in a few words the processes employed for developing the new light, and make a systematic analysis of its good qualities and its defects.

It is no longer Volta's pile that provides us with the current; we obtain it from machines based upon induction. The illustrious Faraday discovered that a coil of isolated copper wires, rolled upon soft iron, becomes the seat of a current of induction, very short, but very intense, when it is brought near the poles of a magnet, and that another current, inverse to the first, and like it instantaneous, yet more intense, is afterwards developed if the coil is suddenly drawn away. Very soon after this discovery was made, Pixii and Clarke invented the first electro-motors. Clarke's apparatus consisted of an electro-magnet which turned rapidly before the poles of a magnet, and was traversed at each revolution by two induction-currents from contrary directions, sufficiently strong to cause very great commotion. It was only necessary to multiply the coils, enlarge them, and increase the power of the magnets, in order to obtain the electric light. This is what was done successively by several inventors, among whom may be specially cited Nollet, Gramme, and Lontin.

[The Professor here briefly explained the principal known magneto-electric machines.]

It was not sufficient to have constructed magneto-electric machines; it was still necessary to regulate the light of the arc. In fact, the carbons consume away very rapidly, not only because they burn in the open air, but because the material of which they are composed is carried away by the current, and shifts from one point to another. An apparatus called a "regulator" was thereupon contrived. It consists of a very delicate mechanism, by means of which the carbons, through being continually brought near to each other by a spring arrangement, are at the same time held back by a lever attracted by an electro-magnet. If the current diminishes or ceases altogether by the separation of the carbons, the spring brings them closer together again; if, on the contrary, it increases by the contact of the carbons, the lever draws them away to a distance which remains nearly constant.

This problem of the regulation of the currents was felt to be of such importance that a legion of inventors sought for and found its mechanical solution. There are, therefore, a large number of regulators in existence, the productions of Duboscq, Foucault, Serrin, Gramme, Carre, Lontin, and others. M. Serrin's regulator is the one generally employed.

Notwithstanding all the care bestowed upon their construction, regulators still leave something to be desired, inasmuch as their action is not continuous. The carbons remain at rest up to the moment when the distance between them attains a determined limit, after which the mechanism brings them suddenly together again, thus causing a more or less sensible alteration of the light, which, occurring at frequent intervals, very seriously interferes with its steadiness, and constitutes what has up to the present time been the greatest obstacle to the employment of electricity.

While mechanicians were looking for this regulator, a young Russian officer, M. Jablochkoff, discovered the means of dispensing with it altogether. Having been kindly admitted into the studio of M. Breguet, he invented the candle which bears his name. Let us imagine two cylindrical parallel carbons, placed vertically, separated by a plate of gypsum, and simply connected at the top by two points. When the current is made to pass from one to the other, the arc is seen to burn at the upper extremity, and descend little by little as the carbons are consumed. It then reaches the top of the gypsum plate, which melts, disappears in smoke, and the destruction of the carbons taking place simultaneously with that of the gypsum, the candle burns slowly and steadily from top to bottom. The simplicity and perfect regularity of this new system, which has at one blow got rid of the unsteadiness of the light, will be readily understood.

We will now turn our attention to the arc, and the best way of studying it is to throw its image on to a white screen. It is not very clear, because it is enlarged, and on account of the light being diffused in all directions, rendering the image visible from all parts of the hall. We see that the carbons become very brilliant, that they are perfectly white, that the positive is more luminous than the negative, that the former diminishes while the latter increases, thus indicating a transference of the carbonaceous matter in the direction of the current. The space left between these two carbons is occupied by a flame much less intense, of a violet tint, animated by a tumultuous transporting movement, and traversed from time to time by sparks of matter carried away by the current. There is no doubt that the current is carried over by the carbonaceous matter itself, spread out in vapor between the two conductors. It is these carbons and this arc, in their entirety, that emits the electric light, the properties of which we are about to study.

First of all we must measure its lighting capacity. It is said that two lights are equal in quantity when, placed at the same distance, they give an equal amount of illumination. If, in order to be equal to the first, we have to withdraw the second to double the distance, thus reducing the illuminating power to one-fourth, we conclude that at an equal distance this second light would give four times the amount of illumination. And so we have the general rule that the quantities of two lights are in direct ratio to the distances at which they have to be placed to obtain equal luminosity, and the measure is taken by means of photometers, a description of which need not here be given. It has been agreed to compare the various quantities of light with that of a Carcel lamp burning white, and consuming 40 grammes of colza oil per hour. We shall, therefore, say that a light is equal to 10, 15, or 100 Carcel burners, in order to express that it sends the same amount of luminosity to the same distance as 10, 15, or 100 lamps of the type chosen, and with which we are going to compare the electric light

Of all the tests of the illuminating value of the light, I shall take that of which the accuracy will be the least contested—one conducted with every precaution by a master of the application of mechanics, M. Tresca. He found that the light furnished by a Gramme machine was equivalent to 1850 Carcel burners. This number is enormous, and its enormity surpasses the proportions our minds are in the habit of comparing. A more exact notion would be conveyed by saying that in order to obtain the same amount of light it would be necessary to burn in one hour 78 kilogrammes (172 lbs.) of oil, or the bulk of gas contained in a balloon 9 metres (30 feet) in diameter. Now, it is this enormous amount of light that we obtain from an electric focus. It is said that it is not necessary, that it exceeds our wants, and that, being indivisible, it will be rather a trouble than a benefit to us. This is an error, for it *is* divisible. First of all, it was divided by M. Leroux. Then smaller machines were employed, which reduced the regulator to 75 burners. Finally, M. Jablochkoff is able to place in the same circuit a very large number of candles, among which the light is divided, each being equal to 50 gas-burners. He can place 37 candles upon the current above cited, and by the aid of the following artifice has gone still further. He prepares some condensers of very large surface, with sheets of tin separated by layers of silk, and then connects the two armatures with the extremities of a machine giving alternate currents. It is evident that the electricity of each current is first of all condensed and then replaced by the contrary electricity of the opposite current, the result being a modification of the composition of the currents furnished. What that modification is, is a point which merits attention that it has not rereived. However, it is always the case that by breaking the circuit at a certain point, sparks surrounded by a very pale yellow flame are given off, the whole being accompanied by a peculiar rumbling sound, constituting one of the most beautiful experiments in electricity.

So much for science; now for its application. If a current is capable of lighting four candles of 50 burners, the same current, when acted upon by the condensers, can supply double the number—namely, eight candles, each one equal, not to 25 burners, but to rather more. We must not seek to push the division farther. The new light must progress; it must not simply replace one Carcel lamp, but must surpass it. The light could, however, be still further subdivided by lighting some rods of carbon, or, as M. Jablochkoff does, a thin plate of kaolin.

[These experiments were described in detail.]

It is not solely on the score of quantity that the light of the arc is superior to all the other lighting focuses, but also for its brilliancy. Given two luminaries of the same extent, affording the same amount of light of the same brilliancy, if one furnishes twice, three times, or four times as much light with an equal extent, there is brilliancy equal to twice, three times, or four times that of the other. Brilliancy may, therefore, be thus defined:

The total amount of light conveyed by the unit of surface to the unit of distance, and the light of the Carcel burner may be taken as unity. Now, according to a learned treatise published by M. Allard, Engineer of Lighthouses, we find that the brilliancy of the arc is at least 600 times as great as that of the flame of a Carcel burner. The eye readily appreciates this difference. In fixing the value of the electric light, he saw it surrounded by divergent rays forming a kind of a halo, and could find no other term of comparison than the sun. M. Fizeau, in fact, compared it to the sun itself for photographic purposes, and found that its power was as 38 to 100. And when powerful machines are employed, it is found that the sun and electricity are about equal, and that in reality the Titans of the nineteenth century have snatched fire from Heaven without being precipitated for it into the unfathomable abyss. Is this immense brilliancy an advantage? When we have looked at the elecctric light, we see before our eyes various colored spots which pursue us persistently, even when the eyes are momentarily closed. These are well-known facts, and I shall not assert that they are not injurious. One of the most learned physicists of Belgium, M. Plateau, lost his sight entirely after having employed it for a considerable time in the contemplation of the prismatic colors. It is with the electric arc as with the sun; we can receive its light, but we must not look at it.

The remedy for these defects is very simple. Surround the light with an opaque globe and you cease to see it; it is, however, transmitted to the globe, in its passage through which its intensity is lowered, and in proportion to the opacity of the globe so will the brilliancy of the light be modified, and consequently less dangerous to the eyes. It is true that this necessitates a considerable loss of the original light; but where there is so much wealth we can well be lavish.

I now come to the most important point of my subject—namely, to study the composition of the electric light. Since Newton's time we have known that solar light is composed of an assemblage of rays, which, by means of the prism, we are able to separate and classify, in the order of refrangibility, from red to violet. There we have arranged, in perfect order, all the simple colors possible—those which, by their combinations, reproduce all the others. The light given by lamps or gas, when analyzed in the like manner, is resolved into the same colors in different proportions; the red, orange and yellow being very prevalent, but little green, scarcely any blue, and no violet. It is a very incomplete light, tending strongly to the red side, but weak or *nil* on the violet; and therein lies the secret of its inferiority.

The electric light is rather the contrary; not because it is not wanting in a single ray, but because, when compared with sunlight, it possesses rather much more blue and much more violet, the latter arising from the arc. Reduced to its carbons, it would conform exactly to the sun. It is this predominance of the most refrangible colors, notably blue an violet, that justifies all the charges brought against the light; and we shall now see that this defect may be corrected.

Not only does the spectrum spread between the red and violet, but goes even beyond it, and from both sides rays project which, though invisible to our eyes, are really there. Those which extend beyond the red are heat rays, of which there are an enormous number in the light emitted by lamps, but scarcely any in the electric light. This light, therefore, is not hot. The rays which extend beyond the violet do not exist in the spectrum of lamp light; in the electric light they abonnd, and it is these that produce photographic pictures. If they are received upon sulphate of quinine, or a solution of the bark of the chestnut tree, they are transformed into luminous rays; they were not visible but become so. The violet rays share this property; they may all be transformed into white light. It follows that the defects in the composition of the electric light may be corrected—that it suffices to eliminate the excess of blue and violet rays to filter the light through sulphate of quinine, and it then becomes absolutely identical with the solar rays. Gas and lamp flames, on the contrary, are wanting in these blue and violet rays, which nothing can possibly give them.

Let us now approach the question of expense. Everything entails expense in its production. We ask for light from motors; what is the cost of this transformation? Foucault one day made that remarkable and celebrated experiment which consists in causing a disc of metal to revolve between the poles of an electro magnet. As long as the latter is not magnetized, the disc may be impelled at great speed, and does not cease revolving for a very long time, and then only slowly. As soon as the iron is magnetized, currents are generated in the disc, which stops suddenly. The production of these currents requires an expenditure of labor, and, in order to keep up that production, it is necessary to lean heavily upon the crank-handle—in a word, to employ force, which is transformed into an electric current. In my laboratory I perform another experiment. I attach a Gramme machine to a Hugon gas engine of 3-horse power. So long as the circuit is open the motor gives to the machine a speed of 1,000 revolutions, without fatigue, and almost without expenditure of force. As soon as the conductors are re-united, a current is developed which requires labor. Then the motor moves slowly and with difficulty, and we feel that considerable resistance has been imported into the working of the instruments. We see great motive power transformed into electricity, and from it we may infer that this wonderful thing we call electricity, about which we know so little to-day, but which will certainly be better understood to-morrow, is only an actual form of movement accomplished in matter or in ether. It is a problem of which the solution is near at hand. In its turn this form of movement that we call "electricity," undergoes a second transfiguration in the electric arc, in order that it may become another kind of movement—viz., heat and light; so that if we take away the medium to which we owe this double transformation, we may say that the motive power is transformed into light.

But if the labor of this motor first of all changes into electric labor, this latter should, in turn, be capable of being converted into motive power. Well, couple together two Gramme machines, and set the first in action by means of a crank, and throw its current into the second; the latter will begin to move; and this experiment shows us that motive power expended, for instance, at Havre, where it would be taken from the sea, might be transmitted to Paris, and there produce its effect. But we are still very far from realizing that dream.

Now, if the question is asked—"How much does the electric light cost?" it will be sufficient to say how many horse power its production necessitates. Now, Tresca's 1850 burners required 7-horse-power, or 0·4 horse per 100 burners. If the light of only 100 burners were produced by the machines, 1·5 horse power would be required. It is a light that costs less the more you produce of it at one time.

Finally, if we are asked how many francs 100 Carcel burners will cost, it will suffice to reply that they require, on an average, one horse power, and calculate the cost of a horse.

[To be concluded.]

Germany and Home Industry.—News comes from Berlin that the German government has given a secret but general order that all articles used in the government establishments must in future be of home manufacture. This command applies, among other items, to steel, files, iron, and even coals.—*Mining and Scientific Press.*

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TUESDAY, JULY 2, 1878.

Official Report of Examinations of Gas for three Weeks ending June 29, 1878, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

Date. June 1878.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gar-Light Co.	Municipal Gas-Light Co.
10	Between 10 A. M. and 3 P. M.	15.82	16.99	19.02	16.34	15.83	
11		14.76	17.27	19.92	16.54	16.13	
12		17.56	18.48	21.88	17.46	16.11	
13		17.34	17.78	20.07	17.38	16.66	
14		16.72	17.59	19.93	16.88	16.27	
15		16.20	16.96	19.26	17.13	16 03	
	Average	16.40	17.51	20.01	16.95	16.17	
17		17.14	17.05	20.54	16.60	16.00	
18		16.98	17.19	19.15	17.43	16.44	
19		16.12	16.91	19.42	17.97	20.16	
20		17.61	17.01	18.02	17.57	20.03	
21		16.30	17.01	21.07	18.58	18.15	
22		16.90	16.44	21.31	17.50	17.84	
	Average	16.84	16.93	19.91	17.60	18.10	
24		17.14	18.05	20.65	18.20	18.14	
25		16.64	17.20	19.75	18.73	18.28	
26		16.46	17.17	20.34	16.96	17.69	
27		17.25	16.43	19.37	16.66	16.93	
28		16.66	16.55	21.19	17.42	16.48	
29		16.86	17.04	20.93	16.96	16.68	
	Average	16.83	17.07	20.37	17.49	17.33	

Sugg-Letheby burner.

E. G. LOVE, Gas Examiner.

[From the Brooklyn "Daily Eagle," June 4.]

The Gas Question in Brooklyn.

Mr. Howell presents some very excellent advice to the local gas companies. It remains to be seen whether their representatives are wise enough to profit by it. The city ought not to have any excuse for going back to the use of oil or kerosene, and what is true of the city can be made true of private consumers. The city should get gas cheaper—not an apparent cheapness in the reduction of the price of gas, for that can be made not to count for much, but in better gas, and in lower aggregate gas bills. The best way to advance the value of gas stock is to make it so that all who use any kind of artificial light will use gas light.

A regular meeting of the Board of Aldermen was held at three o'clock yesterday afternoon, Francis B. Fisher, Esq., President, in the chair.

THE VETO.

The message of his Honor the Mayor, withholding his approval from the resolution awarding the contract for lighting streets in the Eastern District to the New York and New Jersey Globe Gas-Light Co., was read as published in last night's EAGLE.

The amended and reduced bills were also read as already published.

Alderman Ray—I don't know that I am different from other members of the Board, but during the last week I was led to believe that the gas companies had come down some $8 per lamp. I was disabused this morning when I came down to the Hall and found that the gas companies had already come down about one dollar per lamp for the balance of the year. In fact I found that in the eight months we shall save a little over one dollar per lamp, and that that is the great reduction which has been spread broadcast over the city. I don't know where the reporters got their information from, but such I believe are the facts, and now it crops out that there is to be $20 charged for each lamp, and with the extras for lighting, extinguishing, and cleaning, bringing it to nearly $27 per lamp. I don't know how the Mayor justifies himself; I can hardly understand his veto, and in order that I may do so, I move that the communication be laid on the table until next Monday.

Alderman Duane moved as an amendment that the communication be printed and referred to the Committee on Lamps and Gas.

Alderman Murtha did not hear the communication from the gas companies read, but understood that they made modified proposals.

The clerk said "Yes, to the Mayor."

Alderman Murtha—I understand the Mayor's communication to be that, in his judgement, the city should not be called upon to pay more than $20 per lamp, including the cleaning, lighting and extinguishing the same. It certainly seems to me, if the gas companies have submitted propositions other than that, it is not in conformity with the opinion of his Honor the Mayor.

The President—That is so; it is $20 per lamp and $6.30 for lighting, cleaning and extinguishing.

Alderman French—I wish to say a word, sir. I think the Mayor has made a mistake in saying that the New York and New Jersey Globe Gas-Light Co. furnish gas in New York for $15 per year for each lamp.

The President—The error probably arose from the fact that $15 had been saved between the price now paid and the price formerly paid.

Alderman Ray—I did not notice these proposals from the different gas companiss, whether they are addressed to the Common Council or the Mayor.

The clerk said they were addressed to the Mayor and was marked "personal."

Alderman Ray—Surely then we cannot act upon them.

The President—The Mayor has placed them officially before this Board.

Alderman Murtha in explaining his vote said he believed the Board was more than justified in the course it had taken by the facts stated in the Mayor's communication.

The motion made by Alderman Ray to lay the matter over for one week was carried by the following vote:

Affirmative—Aldarmen Dwyer, Black, Kane, Phillips, McIntyre, Murtha, Gunder, O'Reilly, Kenna, Ray, Ormsbee, Petry, Cottrell, Williams, Fritz—15.

Negative—Aldermen Aitken, Baird, French, Duane, Fisher, Dreyer, Easton—7.

A RECONSIDERATION.

Alderman Murtha, at a subsequent stage of the proceedings, said: In the matter of the documents sent to this Board by his Honor the Mayor, in reference to gas matters. We are now in this condition in the matter of gas; we were paying them previous to the contracts the old rates that the company charged in 1877, and the postponement of the subject matter of the documents sent in by the Mayor will simply result in our having to pay the same old rates for another month. In order that a reduction may speedily be made, I now move a reconsideration of the vote previously taken to lay the matter over for one week, in order that it may go to the Committee on Lamps and Gas, to report next Monday.

Alderman O'Reilly—The only objection to that is, the gentleman who made the motion to lay over has left the chamber, and, I believe, has gone for the day, and under these circumstances, I do not think, as a matter of courtesy to him, we should do anything more about it.

Alderman Murtha was not aware, when he made the motion to reconsider that the member from the Thirteenth had gone. His only motive in doing so was that the matter might get into the hands of the committee immediately, so that the Board could reach a conclusion next Monday.

Alderman French thought every courtesy should be extended to an absent member of the Board, but he believed the matter under consideration was of too much importance to be deferred. He believed the Board should take the matter in hand and report on it at the earliest possible moment, and for that reason he had asked the gentleman from the Ninth to make the motion to reconsider.

Alderman O'Reilly asked whether it would be competent for the Committee on Lamps and Gas to bring in a report next Monday saying that certain companies had reduced their price, and recommending that contracts be awarded to them at the reduced rates.

The President said that could not be done before something was referred to them.

The motion to reconsider was then carried by a *viva voce* vote.

Alderman Murtha moved that the documents accompanying the veto message of his Honor the Mayor be referred to the Committee on Lamps and Gas, with instructions to report on Monday next.

The motion was carried.

TUESDAY, JUNE 11.

The Aldermen are never more interesting than when in a philanthropic mood, when their hearts as it were, bleed for the dear public, who have so often bled for them.

* * * * * * * * *

The session yesterday was full of philanthrophy. The gas question was up, and the gentlemen who have been waiting for the old gas companies to come down with their prices—or something—and who, finding that they did not so come down, voted with extraordinary unanimity to light certain streets with naphtha to be supplied without competition by certain philanthropic politicians who have gone into the illuminating business, proceeded to execrate the monopolists once more. It will be remembered that Mayor Howell vetoed the naphtha proposition a week ago, while giving the regular companies a shaking up that must have a salutary effect. His Honor pointed out with a clearness quite new in the vicinity of the

City Hall the abuses of the gas trade in Brooklyn, the arts by which the high prices were maintained, and the other arts which have resulted in burdening the market with a great deal of gas stock that is worth a great deal less than par. But while doing so he took occasion, with equal clearness, to show that the alternative is not gas at extortionate prices or naphtha dear at any price, and certainly not naphtha against which a solid public sentiment enters a protest. As a result of that veto, the Aldermen were forced to reconsider the gas and naphtha question, and the reconsideration took place yesterday The committee to whom the subject was referred, presented the following resolution, which was adopted:

Resolved, That the Board af City Works be and they are hereby directed to readvertise for proposals for furnishing gas (or other illuminating material) for, and lighting, extinguishing, cleaning, repairing and maintaining the public lamps, and supplying gas (or other illuminating material) new lamps when required on the streets, avenues, piers, or places in the city of Brooklyn for the balance of the year 1878, the proposers to state the price, complete for each lamp per annum, with the understanding that he for theyare to receive a ratable proportion thereof for the balance of the year, provided a contract therefor shall be awarded as follows: (If coal gas) to date from May 1 to December 31, 1878, inclusive, (and other illuminating material) to date on or before thirty days from the time the contract is entered into): also for furnishing gas (or other illuminating material) to the public buildings, baths, etc., under the control of the city of Brooklyn. The same to be made in accordance with specifications on file in the Department of City Works, the time table for lighting and extinguishing the same to be furnished by the Board of City Works.

Alderman French, who led off so handsomely in favor of the naphtha men four weeks ago, was chairman of the committee, and led off yesterday in a neat little speech. The Alderman's career as a gas reformer began when the scheme to give Jourdan & Co the mutual charter was broached. Mr. French favored Jourdan very warmly, and had no difficulty in showing that from the mutual enterprise the most beneficial results would flow.

Alderman Griswold, who also perceived the beneficence of the Jourdan enterprise, followed Mr. French yesterday in execration of the tyranny of the old companies. Mr. Griswold is never so strong as when eulogizing himself; this is, doubtless, due to his perfect acquaintance with the subject. He thought the naughty press might suspect something wrong in the naphtha movement, but conscious of his own integrity he had decided to cast his voto for "Coe, Naphtha and Reform." There is something touching in the fear that several of our Aldermen always have when entering upon any beneficial enterprise, that their motives will be aspersed. It is difficult to account for this.

* * * * * * * * *

Aldermen Burnet and Murtha presented the anti-naphtha case, and recommended the making of contracts for the remainder of the year with he gas companies. A business point was urged by Alderman Burnet, when he said:

There was one point the committee had not dreamed of, it was that they had induced six large corporations to extend their capital in laying pipes through the streets and fitting up their works, and these companies had paid $150,000 a year in the way of taxes, and as long as they acted fairly and within reason, they were just as much entitled to the protection of the Common Council as were the merchants doing business along the streets. If they should introduce a foreign company in Brooklyn, he supposed he might call the New York and New Jersey company a foreign company, then the old gas companies would be fairly entitled to reduce their capital one-half, and instead of paying $150,000 taxes, they would pay only $75,000. If the companies did that it would be lawful and right and only be taking such precaution as any business man would take, and so although the city might save $30,000 or $40,000 on the price of gas it would lose $75,000 in the way of taxes, and if the members of the committee were satisfied with any of that kind, he certainly was not.

This is true to this extent—the gas companies are entitled to justice at the hands of the public authorities, and to wreck them for the purpose of enriching a few political adventurers cannot benefit the public. Moreover, Mr. Burnet shows clearly enough how the making of any contract with the Naphtha people, such as has been proposed, would result, not in profit, but in actual loss to the city.

A regular meeting of the Board of Aldermen was held at two o'clock yesterday afternoon, Francis H. Fisher, Esq., President, in the chair.

THE GAS CONTRACTS.

The following was read:

The Committee on Lamps and Gas, to whom was referred the proposals from the various gaslight companies relative to the cost of furnishing gas for street lamps, etc., sent by his Honor the Mayor to this Board June 3, 1878, respectfully report:

They have given the matter as careful a consideration as the time allotted them would permit. In examining the proposals the committee find a small reduction from proposals submitted to the Board May 13, 1878, in answer to advertisements.

The committee consider the proposals sent to this Board by his Honor the Mayor to be not only informal and unjust to the bidders whose proposals were received and opened in due form by the Board of City Works on May 15, 1878, and duly advertised in the corporation papers as per requirements of the charter. When your committee take into consideration the great injustice done to the taxpayers of this city by the gas companies for years past, and their unwillingness to concede any reasonable reduction when pressed by your committee, and when, in view of the great change of the cost of material and labor in the manufacture of gas and of the prices paid to the city of New York, being less for lighting 21,000 lamps than they compelled the city of Brooklyn to pay for lighting 14,000 lamps; and when we also consider the difference in the number of houses we burn gas in and lamps, less than in New York, also the difference in candle power, admitted by the Brooklyn companies to cost eight per cent. more than our gas; still with the above facts no concession was made until the Board of Aldermen, by a large vote, authorized the Board of City Works to light the lamps of the public streets with coal gas or other illuminating material did we find any change in the prices charged the city by the various gas companies. And now that other competitors are anxious to furnish the city with a light which in the judgment of your committee will compare very favorably with coal gas at a much less cost, the said gas companies by an informal proposal, knowing what has been done, now offer to his Honor the Mayor that they will make a still further reduction.

The reductions in the bids received on May 10, less than paid the last two years, is as follows:

Williamsburgh Gas Co., $19 for 8 mos.		$3,715 83
Brooklyn Gas Co., $18 for 8 mos.		5,548 55
The 4 other companies, $19 for 8 mos.		9,401 00
Total		$18,665 38
Public buildings about		950 00
Total less		$19,615 38
The N. Y. and N. J. Globe Gas-Light Co. $23 per year, if contract had been completed, would have saved the city for 7 months to December 31, 1878.		9,754 70
Total		$29,370 08

The proposals made to his Honor the Mayor make the following reductions from the proposals submitted to this Board May 13:

The four gas companies	$6,204 66	
The Williamsburgh Company	4,681 95	
The Brooklyn Company	2,005 50	
		$12,892 11
Gas for public buildings, $2 per 1000 feet from 5 companies, and from the Brooklyn Gas Company at $1 82½ per 1000 feet, which will make a further reduction of about		2,000 00
Total saving, if the last propositions are accepted		$34,507 49

Your committee believe from the information they can obtain that it would be for the interest of the taxpayers, as well as a fair and onorable way to treat all parties who desire to enter into competition to furnish light for our city, that we should readvertise for coal gas and other illuminating material, as well as to obtain for our taxpayers relief from the gas companies who have valuable franchise from the city; also, that we may compare favorably with the prices paid by the city of New York whose contract for lighting the street lamps for 1878 is $159,000 less than the contract for 1877.

Since the question of lighting the public lamps with gas or other illuminating material has been before the people, other parties beside those who submitted proposals to light the public lamps are anxious to propose to do said work if an opportunity is given.

Your committee respectfully offer for adoption the following:

Resolved, That the Board of City Works be and they are hereby directed to readvertise for proposals for furnishing gas (or other illuminating material) for and lighting, extinguishing, cleaning, repairing and maintaining the public lamps, and supplying gas (or other illuminating material) for new lamps when required on the streets, avenues, piers and places in the city of Brooklyn, for the balance of the year 1878, the proposers to state the price complete for each lamp, per annum, with the understanding that he or they are to receive a ratable proportion thereof for the balance of the year, provided a contract therefor shall be awarded as follows: (If coal gas) to date from May 1 to December 31, 1878, inclusive (and other illuminating material to date, on or before thirty days from the time the contract is entered into), also for furnishing gas (or other illuminating material) to the public buildings, baths, etc., under the control of the city of Brooklyn. The same to be made in accordance with specifications on file in the Department of City Works, the time table for lighting and extinguishing the same to be furnished by the Board of City Works.

(Signed) JOHN FRENCH,
JOHN DREYER,
GEO. W. WILLIAMS,
JAMES KANE,
Committee on Lamps and Gas.

Alderman French said the committee had given the matter very careful consideration. They had received a number of proposals for lighting the city with other materials than coal gas, and believed it was for the interest of the taxpayers that there should be some consideration given to that subject. The committee did not have any interest in any gas company, and so far as he knew there was no member of the Board had any interest one way or the other in a gas company, and it was simply the interest of the taxpayers that had to be studied. New York was paying $150,000 less for gas this year than last, and it had seemed to the committee that the reduction offered by the companies of this city was not enough, and it was less than ten per cent. of the amount paid last year. Continued agitation of the question had brought the gentlemen interested in gas to realize that they must make a still further reduction, and whether the city of Brooklyn was to be benefitted by readvertising was for the Board to say, although that was the only plan that suggested itself to the committee, by which justice could be done to all parties.

Ald. Burnet moved that the resolution be amended by striking out all reference to other illuminating material. His reason for making the motion was, he said, that he did not believe in naphtha. He had made inquiries about among the people living in New York, where it is used, and had found, without exception, a decided condemnation of it. In the first place it would not burn when wanted, it did not give a good light, and then it would and did explode. From conversation he had held with many people, he found they were willing to pay for gas if they could get it at a reasonable price, and he thought the wishes of the people ought to be taken into consideration by the Common Council. He knew it was a popular thing to talk againt these great overgrown corporations, but it should be remembered that they had made the city what it was. They had been of great benefit to the city, they were paying a large

amount of taxes, and were entitled to protection at the hands of the Board. When they were paying tens of thousands of dollars into the city treasury every year, he held that it was the duty of the Board to see that they were protected. He had heard it said in Albany not long ago that there was not a single corporation in the State of New York that had not been attacked by the law making power, and for no reason at all, but because they had happened to be great, powerful and successful.

Ald. Baird was astonished to hear the gentleman from the First talk in the manner he did, and then as a member of the Lamp and Gas Committe, send to the clerk's desk and had read letters from the authorities of New Haven, Hudson, Bridgeport, Burlington, Meriden, Watertown, Glenns Falls, New Rochelle, Newport, Willimantic and White Plains, setting forth that naphtha had been used for the purpose of lighting the street lamps in those places, that no fires or explosions had been caused by its use, and it had not caused an increase to be made in the rates of insurance.

Ald. Burnet guaranteed to take any patent medicine, the meaner medicine it was and the poorer the better, and he would get 500 recommendations for it in any city in the United States. He did not profess to state what he knew about naphtha gas of his own personal knowledge, but only what he was told by a person in whom he had perfect confidence, and from him he had learned that there had been at least half a dozen explosions in Harlem, and all of them caused by naphtha. But there was a question beyond all that, it was that the people did not want that stuff, they wanted something better. There was one point the committee had not dreamed of, it was that they had induced six large corporations to extend ther capital in laying pipes through the streets and fitting up their works, and those companies had paid $150,000 a year in the way of taxes, and as long as they acted fairly and within reason, they were just as much entitled to the protection of the Common Council as were the merchants doing business along the streets. If they should introduce a foreign company into Brooklyn, he supposed he might call the New York and New Jersey Company a foreign company, then the old gas companies would be fairly entitled to reduce their capital one-half, and instead of paying $150,000 taxes they would pay only $75,000. If the companies did that it would be lawful and right, and only be taking such precautions as any business man would take, and so although the city might save $30,000 or $40,000 on the price of gas it would lose $75,000 in the way of taxes, and if the members of the committee were satisfied with anything of that kind, he certainly was not.

Ald. Griswold was convinced that the gas companies had become rich and powerful corporations, and they had watered their stock frequently. He did not know any man in the world who was interested in the naphtha business, but he was called upon to vote on a question where he saw by the press that there was suspicion cast on a man if he voted one way, and if he voted another way there was also suspicion cast upon him. He was opposed to naphtha, kerosene or benzine, and was as much afraid of them as the woman was afraid of the gun without lock, stock or barrel. She was afraid of it. [Laughter.] They were engaged in a struggle on behalf of the people of the city against a number of powerful corporations, and he believed the people would give the Committee credit for the reduction made by one of those corporations, and that the Williamsburgh Company, and in that case at least they ought to be thankful for the aid they had received from naphtha. He did not care what the press might say about him, for he was there simply to do his duty, and if by readvertising for "gas or any other illuminating material" they could effect a revolution in the prices now paid by the city he should be in favor of adopting the resolution, for he was there to do his duty, and should do it every time without fear or favor.

Ald. Murtha offered the following as a substitute :

Whereas, The Common Council having directed proposals to be invited for lighting the street lamps and public buildings with gas or other illuminating material for the year 1878, and,

Whereas, Proposals were received from the several gas-light companies located in the city and likewise a proposal from the New York and New Jersey Globe Gas-Light Company, stating the prices at which the respective companies would furnish gas, and, in the case of the Globe Company to furnish naphtha ; and,

Whereas, The Common Council accepted the proposal of the New York and New Jersey Globe Gas Company to light the lamps in the Eastern District with naphtha gas, and likewise directed the Board of City Works to readvertise for proposals for gas or other illuminating material for all the territory embraced in the Western District ; and,

Whereas, The said award to the New York and New Jersey Globe Gas-Light Company was vetoed by his Honor, Mayor Howell, and likewise the resolution to readvertise the Western District ; therefore,

Resolved, That the Board of City Works be and hereby is directed to enter into contract with the Brooklyn, Williamsburgh, People's, Nassau, Citizens' and Metropolitan Gas-Light Companies to supply gas for the street lamps at the rate of $20 per annum for each lamp, this price to include the cost of lighting, cleaning and extinguishing, to take effect May 1, 1878, and the modified price offered by them to the Mayor for gas for public buildings, provided the several companies above enumerated consent to modify their bids already received to conform to the terms and conditions of this resolution, and in compliance with specifications heretofore advertised by this Common Council.

Ald. O'Reilly, in the chair, said the resolution was not in order at that time. The motion before the Board was that by the gentleman from the First to strike out all reference to other illuminating materials.

Ald. Murtha asked whether his resolution did not come up in the shape of a substitute.

The Chairman said it should be in order as a substitute.

Ald. Murtha said he had always been desirous of compelling the existing gas companies to take such action as would give the city a supply of gas at a reduced rate. In that spirit he had voted to accept the bid of the Naphtha Company. His Honer, the Mayor, in the discharge of his duty had deemed it wise to veto that resolution. The proposition embodied in his resolution was to the effect that assuming they had been paying 30 per cent. in excess of what had been charged in New York, the reduction would make the average cost about $20 per lamp, including lighting, cleaning, repairing and extinguishing. If that sum had been paid in New York, no reasonable man would assume that more should be charged in Brooklyn, where the cost of manufacturing gas was not higher than in New York. He was satisfied from an examination he had made that at the price named the gas companies would make a reasonable degree of profit to pay them for the capital invested, and also enable them to leave intact the moneys they had in use. He believed the Board had the right to make the modifications proposed on the basis already received, and then if the proposition should not be accepted, the Board of City Works could go to work and readvertise. The proposition embraced in this resolution would save to the city not less than $30,000 over and above the reduction made in the proposition submitted to the Mayor, and the reduction would, in the aggregate, reach $100,000.

The chairman said, although he had recognized the right of the gentleman from the Ninth to offer his proposition as a substitute, still he could not recognize the legality of accepting bids from his Honor the Mayor.

Ald. Burnet asked how they could accept bids when they had not been regularly advertised for.

Ald. Murtha said they were in a position to accept bids or modification of bids whenever there was no interest to be jeopardized and no assessments to be levied. Furthermore, he had been assured by the Corporation Counsel that the Court of Appeals had decided that where there was but one company in a district, the city authorities had the right to make a contract without advertising, if they felt disposed to do so.

Ald. Fisher had no doubt but that the gas companies would be well pleased with the action of the members of the Board who studied their interest and had no question but that those members who reflected the interest of the people would have their most profound respect. The gentleman of the First was correct when he spoke of those gentlemen as public spirited citizens, but the Board had had experience not only with gas companies, but with other soulless corporations, and acts were performed by them which the individuals composing them would not endorse. Therefore, he held that while they were laboring for the people they were not depriving themselves of the respect of those gentlemen in their individual capacity. He did not remember that there was any objection made to taking those franchises, on the contrary, the corporate authorities never had to ask these people to come and make gas, for there had always been a rivalry to get control of the business. If it had not been that some other illuminating material had come to the surface they would still have been paying $30.25 for each lamp, and now they were willing to take $26.29. That result was simply owing to the fact that this Board had encouraged competition, and he thought it was their duty to still further encourage it. A gentleman who had been honored by the people with one of the highest offices in their gift, that gentleman became the agent of one of the rivals of the old gas companies, and had said to him if the gas companies were willing to do what was right, that was light the lamps at $20 per lamp, the proposition of the Naphtha Company was to be at once withdrawn, and he should be satisfied, and if this proposition for a further reduction from $26.29 went before the Board of City Works it would meet with no heartier approbation than that of Jno. W. Coe. He was glad to listen to the letters introduced by the gentleman from the Nineteenth, and although the member from the First had said he could obtain plenty of certificates for patent medicines he ventured to say that they would not be from reliable authorities. The fact of the gentleman from the First making threats that the old companies would probably reduce their stock, was only another evidence of what soulless corporations would do, and if competition should be stopped the price would go back to $30 per lamp.

Ald. French suggested that the substitute should be so amended that if the gas companies did not accept the proposition by Wednesday of the present week, then the Board of City Works should be directed to readvertise.

Ald. Griswold was in favor of giving them until Saturday.

Ald. O'Reilly said the proposition was a new one, and he believed the proper way was to adopt the report of the Committee.

Ald. Murtha offered to amend his resolution so that the gas companies should notify the City Clerk of their acceptance of the proposition within twenty-four hours after the approval of the resolution by his Honor the Mayor.

Ald. Fisher said his idea was to amend the report of the Committee by adding :

Resolved, That the Board of City Works be and are hereby authorized to enter into contract with any of the gas companies to light, repair, extinguish, clean and furnish gas for lighting street lamps at the rate of $20 per lamp per annum, from May 1, 1878, and in case all the gas companies shall enter into contract before the expiration of the advertisement ordered in the foregoing resolution the Board of City Works shall withdraw such advertisement.

Ald. Murtha withdrew his substitute and a vote was taken on the motion of Ald. Burnet to strike out all reference to "other illuminating material."

It was lost by a vote of one, Ald. Burnet, in the affirmative, to twenty in the negative.

Ald. Murtha then offered his substitute, and it was voted down as follows:

Affirmative—Ald. Black, Phillips, Murtha, Gunder, Griswold, Kenna, Cottrell, Baird—8.

Negative—Ald. Burnet, Dwyer, Aitken, Kane, McIntyre, O'Reilly, Ormsbee, Williams, French, Duane, Fisher, Dreyer, Easton—13.

The question was then taken on the resolution offered by Ald. Fisher.

It was lost by the following vote:

Affirmative—Ald. Black, Murtha, Gunder, Griswold, Kenna, Cottrell, Baird, Fisher, Easton—9.

Negative—Ald. Burnet, Dwyer, Aitken, Kane, Phillips, McIntyre, O'Reilly, Ormsbee, Williams, French, Duane, Dreyer—12.

The report of the Committee was then adopted by the following vote:

Affirmative—Ald. Dwyer, Aitken, Black, Kane, Phillips, McIntyre, Murtha, Gunder, Griswold, O'Reilly, Ormsbee, Cottrell, Williams, Baird, French, Duane, Fisher, Dreyer, Easton—19.

Negative—Ald. Burnet, Kenna—2.

Ald. Griswold offered the following:

Resolved, That the financial officers of the city be directed to pay, after this date and until a contract be entered into with the gas companies for the balance of the year, at the rate named in their proposal to his Honor the Mayor and no more.

Ald. Black said it took two to make a bargain.

Ald Burnett moved that it be referred to the Committee on Law.

Some Questions About Gas.

The City of Yonkers has just contracted for lighting the public lamps for $33 per year, instead of $22.50, the price paid last year. We are also charged 28 cents a hundred for gas, instead of 15 cents which has been the price of the Yonkers Company for some time past. *The Statesman* has, therefore, thought this a suitable occasion to investigate the gas question, and in pursuit of information, has interviewed President Cornell. He said that the increased price was probably evidence that the two companies had got tired of making gas at a loss, but that the price was still lower, relatively, than in New York and other neighboring cities.

To the question, "Why don't the two companines consolidate and make one company?" he replied.

"Why should they consolidate? We didn't bring the new company here. We don't want it here. But the local authorities did want it here, and authorized it to come in spite of any thing we could do to prevent it, and we must accept things that we can't prevent. The people of Yonkers as represented by their local authorities have shown that they want two companies here.

"But don't it cost more to run the two companies than it would to run only one covering the whole business?"

"Of course it costs more. But if the people insist on having the luxury of two companies, and are willing to pay for it, why shouldn't they have the luxury of the two companies?"

"But how do they pay for it? Don't they get the gas cheaper in consequence of the competition between the two companies.

"No. Not in the long run. On the contrary they pay more for it. For they have to pay a fair return on the money invested in the business, and the expense of operating it. The Yonkers Company has more than $300,000 invested in this business. This is hard cash, expended in extending mains, enlarging the works, and making ready to supply all consumers And we could supply double the consumption that we now have. But here come in the new company, and they claim, I am told, to have invested $130,000 here for their establishment. They want an adequate return for this outlay. They claim to have an annual consumption of about seven million feet. We had last year about 21,000,000 feet, making 28,000,000 feet in all. Now, the old company could supply the whole of it, and twice as much more, without any additional cost for street mains, or works or apparatus, ane saving also all the additional expense of running a second establishment, and the interest on its cost. But their money is already spent. If we should consolidate we should have to add all their cost of construction to ours, and make that much larger investment to pay interest and dividends on: so that, any way we can fix it, since the money has been spent, there is no way for it but to add the increased cost of production to the price of gas. Thus at the present time the two companies in Yonkers each charge 28 cents; but had there been only the old company the price would now probably be 25 cents for gas, and $30 instead of $33 for public lamps."

"But how can you say that the price would be 25 cents, when you were charging $4 a thousand before the new company came here?"

"Yes, and you may say that we were charging $5 before the new company came here. But then coal cost us $15, and other things in proportion. And as these expenses came down we reduced the price of gas until it was $3 in June, 1875; and this was six months before the new company was in operation. And then we were paying $7 for gas coal, and now we get our supply at from $5 to $6, and other things in proportion—so that we would naturally have dropped off the fifty cents, and made the price $2.50 had we not been put to all this loss by the new company."

"Then you think the city and the people of Yonkers will lose, in the long run, by the coming in of the new company.

"Yes, I do; I don't see how it can be otherwise. But if the local authorities had been equal to the occasion, they had the opportunity of making a good bargain for the city when the new company asked for permission to come in. Under that pressure, and in order to keep out the opposition, the old company would no doubt have made an agreement that would have been a substantial gain to the city and the people of Yonkers, and probably to the company itself also. But the local authorities did not know how to make the most of their opportunities. They imposed present loss upon the company, and ultimate loss on themselves and their constituents. That is just what the local authorities of New York have been doing. They authorize company after company to come in and tear up the streets, causing loss and inconvenience to city trafic, and creating new and costly corporations, to which, in the end, the people of the city will have to pay a handsome profit. In fact the city of New York is now paying a million dollars a year more for gas than they would have paid if the local government had been wise."

"But the New York lamps have just been let for $12 each per year, while here in Yonkers you make us pay $33. Is not that gain to the city of New York the result of opposition?"

"But it is not a gain. Remember that the city of New York means the people who live there. The people as a whole have a much larger interest in reducing the price to private consumers, than in cutting down the cost of the public lamps. Now, take the portion of New York below Thirty-fourth Street. This was supplied by the Manhattan Company down to Grand and Canal streets, and the New York Company below those streets. These companies sell together about two thousand millions feet annually. Their price is $2.50, or an aggregate of nearly five millions of dollars annual cost of gas. Now, instead of making an agreement with these two companies, as a condition of keeping out opposition, to reduce the price to $2.00, saving fifty cents on two thousand millions feet, or about a million of dollars annually, the city authorities have authorized the Mutual Company, and then the Municipal Company, to come in and lay mains wherever they choose. The inevitable result will be to keep up the price of gas indefinitely. It is true the lamps are lighted this year for $12, instead of $25 or $28, which would there be a fair price. This, on ten thousand lamps lighted by those two companies, makes a saving of perhaps $125,000—to offset the million of dollars unnecessarily paid by private consumers—because the city authorities have not taken advantage of these opportunities to make advantageous arrangements with these two companies. The companies are defending themselves the best they can. And the local authorities boast of the great saving they are making in gas for the public lamps. But the people don't stop to reflect that every dollar saved this way costs five dollars to private consumers all over the city."

"Then, you think the price of the Yonkers lamps bears a fair proportion in the price of gas to private consumers?"

"Yes. Private consumers pay $2.80, with five per cent. off for prompt payment, say $2.66 net, while the gas for the lamps is put at $2.25. This is fair, as the city is a large consumer and sure pay. The new lamp contract calls for three-feet burners 3,833⅓ hours a year, making about 11,500 feet per year or $26 for the gas. The other seven dollars is the actual cost of lighting, maintaining and repairs. We have consented to do, without charge, a great deal of work that is paid extra in New York, and this makes the cost of maintainance heavy to us."

"If you make this discount to the city because the city is a large consumer, why don't you make a proportional discount to the factories and other large consumers?"

"We do. All consumers of $100 per month have a discount of ten per cent. for prompt pay. And we allow the ten per cent. to all churches, schools and charitable institutions, whatever their consumption."

"Have their been any examples of such agreements by which municipal corporations grant exclusive privileges to gas companies, and secure an equivalent in price or otherwise?"

"Yes, several such attempts have been more or less successful. The city of Paris, more than twenty years ago, made a contract with the five opposing gas companies then in operation in that city, under which they have been consolidated in one company with exclusive right to sell gas, with certain other covenants; and in return the gas company divides with the city all profits beyond a certain amount stipulated in the contract. Under this agreement gas is now sold in Paris at about $1.50 a thousand feet, and the city of Paris received for its share of the profits of the business of 1877, about eight and a half millions of francs, or considerable more than a million and a half of dollars. There is an example for New York."

Danger.—An Explosion of Naphtha Gas Expected.

THE JUDGES OF THE SUPREME AND CITY COURTS FOREWARNED OF THE DEADLY INGREDIENTS BENEATH THE COURT HOUSE.

The following communications were sent this morning to the Judges of the Supreme and City Courts. The contents assure their Honors of what they more than suspected before coming this morning, when the whole building is filled with the abominable smell of the gas, or whatever it is, the facts stated are calculated to be startling:

DEPARTMENT OF HEALTH, ETC.,
BROOKLYN, June 25, 1878.

Gentlemen: I enclose a copy of a communication forwarded to the department of Fire and Buildings in reference to the Gas works in the Court House. This Board has not yet decided to act upon the portion of the complaint relating to the obnoxious odors produced in the use of the gas. The question of danger to life pertains to the office of Fire and Buildings: hence the reference to that department of the accompanying report. Very respectfully,

H. A. LAFETRA.

BROOKLYN, June 22, 1878.

Gentlemen: I am directed to forward the enclosed report of one of our inspectors in reference to the gas works used at the County Court House, deemed by

him and by this Board to be unsafe. Will your Honorable Body have a careful examination made of the said works and take such action as the necessity of the case warrants? Very respectfully,

H. M. LaFetra, Secretary.

[Extract from Mr. Powers' Report.]

Regarding the safety of this machine, I have examined the tanks, generator and gas holder. The tanks are in the yard, beneath the surface, and are charged about once in fifteen days with eight barrels of gasoline. An air pressure of twenty-five pounds to the square inch forces the liquid through a pipe into a heated surface in the generator within the building. It is there vaporized and enters the gas holders. The machine is in perfect working order at present, but the mechanism which renders it safe or otherwise is complicated and delicate, and therefore liable to become deranged from small causes.

The failure or breaking of a cam or the jamming of the gasometer in rising would ensure the blowing out of the water seal. Then the gas would continue to be made so long as the air pressure lasted, and would leak into the building to the whole extent of the production. This gas when mixed with air is a highly explosive mixture, and any part of this which may reach a flame would fire the whole of it. Then the general or partial destruction that commonly occurs, hides the immediate cause of it, but certainly shows want of ordinary safety. An explosion of this kind occurred recently at the County Jail, where one of these machines is in use, and although very partial in the destruction the cause seems not to have been found out. The gasoline from which this gas is made is very properly stored outside the building, but this liquid, though very inflammable is not really explosive. It is very volatile, and its vapor only becomes explosive when mixed with air. Therefore it is this mixing with air that makes it especially dangerous, while this process of mixing and storing the mixture for use is done within the building.

From this it follows that the building would be more safe if the gasoline was stored in the building and the mixing and storing of the gas was done outside, where all accidental leakage would be in the open air.

From such considerations as these, it is my opinion that the apparatus is unsafe. Respectfully submitted.

James J. Powers, Assistant Inspector.

West of Scotland Association of Gas Managers.

[Concluded from page 255. vol. xxix.]

PRESIDENT'S VALEDICTORY ADDRESS.

The President then delivered the following Valedictory Address:

Gentlemen: I have great pleasure in meeting you all, after the labors of another winter, for mutual improvement on subjects connected with gas lighting, at this the sixth annual meeting of this Association, and the first Gas Managers meeting ever held in this town, which is famous for many arts, including gas engineering. It also affords me much pleasure to state that during the year now numbered with the past your committee are not aware of a single instance wherein the Associations efficiency was impaired by death. During the same period there has been no demand for aid from the benevolent fund. Gentlemen, these are pleasant conditions, which few Associations with a like membership enjoy, and the facts mentioned say much for the general health and prosperity of the members.

The Association may be compared to the science of gas lighting, inasmuch as it is always progressing. To-day we have a number of extraordinary and ordinary members admitted, giving us a grand total of over 200 members. I agree with your committee, that the connection members have with this Association should be severed, and pass into history, whenever they allow themselves to run more than two years in arrears. If an Association is worth being connected with, it should be regularly supported.

PRIZE PAPER.

The sub-committee appointed to award Messrs. A. and J. Stewart's £10 prize for the best paper on "The Most Economical Mode of Manufacturing Gas from Coal or Shale to Produce an Illuminatjng Power of from 25 to 30 Candles" consider it right to allow the summer rather than the winter time for the preparation of papers. Managers who have forwarded papers can amend them, should they think fit. The date when all intending competitors must remit their papers to the Secretary will be duly advertised in the Journal of Gas Lighting. I trust the papers will be numerous, and worthy the liberality of the donors.

ANNUAL REPORT ON THE GAS SUPPLY OF SCOTLAND.

Your last report on the gas supply of Scotland is, I believe, the most complete published. It is gratifying and encouraging to know that many, if not all, the Gas Managers who opposed the report on its introduction, a few years ago, are now cognizant of its great utility, and readily subscribe the important information it contains. "Every art is improved by emulation." Ours, being no exception to the rule, is greatly improved by the emulative spirit the report engenders among managers. I will now venture to occupy your time and attention with remarks suggested by a few columns of the report.

CARBONIZATION.

To secure efficiency and economy in the carbonizing department, there should be at least from 15 to 20 per cent. more retort power than is required to produce the maximum daily make. One of the advantages of this is that retorts can be worked until it is prudent to let them out, whereas, with limited carbonizing surface used, but often good, retorts have to be pulled out at the beginning of a winter, lest they might break down about the season of the maximum daily make, when they cannot be dispensed with, and when there are no others to fall back upon. To prevent this loss, and gain numerous other advantages, considerable additions will require to be made to the benches of many a retort-house in Scotland.

Many great improvements have been made in the setting, heating, and working of horizontal retorts since the time our great countryman—Murdoch—applied coal gas to useful purposes, and ingenious machines have been constructed for charging and drawing them; but, unfortunately, they can only be economically employed in large works.

Gravity, the cheapest force in nature, has not been so extensively applied to the carbonization of coal as, in my opinion, it ought to. It enables the oil manufacturer to carbonize fully twice the quantity per man that we accomplish with our horizontal settings, in the ordinary way of working. At the Dumfries meeting of this Association, our worthy member, Mr. Andrew Scott, placed before us a vertical setting of retorts, which, in my opinion, contains all the conditions essential to the perfect carbonization of coal in the manufacture of gas. In this vertical setting, the heated coke of the previous charge is made to carry on the carbonization of the non-gasified products of the fresh charge, while, at the same time, poorer gases are produced by the decomposition of water, which add very considerably to the quantity and quality of the gas, by picking up the surplus hydrocarbons that flow in our present system to the tar well, to contribute fortunes to the tar distiller. The vertical has another great advantage over the horizontal setting, in being so well adapted for the introduction of gravity to work them economically.

PRESSURE ON RETORTS.

The fifth column of report shows the pressure on retorts to vary from $\frac{3}{4}$ inches to 13 inches. I have no hesitation in stating that any works with anything like a dozen inches of pressure on the retort must be working at a great loss, for it is an undisputed fact, that the greater the pressure on the retort, the greater will the crop of carbon be, which not only robs the gas of its principal illuminant, but greatly retards the proper carbonization of the coal. Anti-dips prevent, to a great extent, this troublesome deposit, by reducing the pressure due to the seal, and abolishing the pulsations it produces, which Mr. Young has shown to be the principal cause of excessive depositions in highly heated retorts. Unfortunately most of the anti-dips are so liable to cause accidents through not being self-acting, that managers generally "rather bear the ills they have than fly to others that they know not of." I would strongly recommend for your careful perusal an able paper by Mr. Forstall, of New Orleans, read before the American Gas-Light Association, "On the Advantage of Removing the Hydraulic Seal during the Distillation of Coal." It appeared in the *American Gas-Light Journal* of November 2, 1877, and is elaborated on data obtained from long and careful experiments, which ably support the following conclusions:

1. With equal heats from equal weights of coal, little or no increase of gas is obtained by the removal of the hydraulic seal, unless a vacuum is maintained in the retorts; in which case the increase is not from the coal, but from the furnace; and the loss of illuminating power overbalances the gain in volume.

2. The removal of the seal prevents effectually the excessive deposition of carbon caused by over-decomposition of the gas, and thus improves its illuminating power.

3. With an equal daily production of gas, the durability of clay retorts is nearly doubled by the removal of the seal, provided a slight pressure be steadily maintained within them during the process of distillation.

A physician must know a patient's trouble before he can properly apply medicines to effect a cure. In like manner we, knowing the bad effects of the dip, and the dangers of the anti-dips, anticipate a remedy in an apparatus that will automatically maintain a steady pressure of say one inch in the retort, and at the same time prevent pulsations. With a view to accomplish this, Mr. Young, of Clippens, has recently invented and patented a dip, which takes advantage of the pressure necessary to automatically produce a seal, to effect the precipitation of the tarry and sooty matter from the crude gases, at a high temperature, as they enter the hydraulic main, in a continuous stream, and free from any pulsatory action. Should practice prove this dip to perform its varied and important duties satisfactorily—and of that I am sanguine—it will be a most useful addition to our plant, and a step towards the perfection of a process of the utmost importance to us all.

CONDENSATION.

The condensation columns, area, and capacity, indicate that no hard and fast line is accepted to affect the condensation of our crude gases. The annular condenser is, perhaps, the most popular. Its only advantage over the other ordinary form is that it looks a little better, or is a trifle cheaper. Its principle of cooling the gases is identical with the others, and, consequently, of much the same value as a condenser. Our knowledge of condensation is now directing us towards separating the crude gases from the tars at high temperatures, because we know the tars have then no affinity for the hydrocarbon vapors, which they absorb and carry to the tar-well at low temperatures, as they do in the ordinary forms of condensers. The only condenser that takes advantage of this knowledge, is the Aitken and Young "Analyzer," which this Association had the honor of introducing to the gas world. Dr. Wallace, one of our most eminent chemists and gas examiners, has tested it, and declares it "an immense step in advance of anything we have had before." The tar distillers also give it an excellent testimonial for denuding the tars of the naphtha vapors, by refusing to purchase them. There is a feeling among Gas Managers generally that it is the best condenser we have yet had; but it is not, and I fear will not be, generally adopted until the patentees will guarantee a price for the tars that will, when carefully calculated, leave a fair margin of profit for diffusing the naphthas through the gas, instead of the tars. Mr. Aitken, of Falkirk, is to honor us to-day with a paper

"On the Influence of Aqueous and other Vapors on Illuminating Gas." You will have observed, in the JOURNAL OF GAS LIGHTING, many able letters by M. Bremond and others on this subject, which is surrounded with much interest to us all.

SCRUBBERS.

It is astonishing how few works adopt the scrubber—perhaps the most profitable vessel in our plant; it not only saves much labor and material expended on the purifiers, but produces a valuable commodity, which is an item of considerable importance to the revenue of every company who employ it.

The success that has attended liquid purification in the past, and the chemical knowledge we are ever gaining, induces me to think that the nineteenth century, famous for great discoveries, will have another added to its credit—one that will by liquids deprive coal gas of its gaseous impurities, and that in such a manner as to enable us to recover the sulphur from the sulphur compounds. The ideal of a chemical works, "that there should be no waste products," should be ours. I know three members of this Association who are studying and experimenting in this direction of our science, and obtaining results so encouraging and satisfactory that they believe the "right track" is becoming visible, although many difficulties still blockade it. Let us hope the reward—success—that invariably attends perseverance in a good cause, will soon be theirs.

PURIFICATION.

To purify coal gas economically and well, the purifying space should be much greater than that possessed by many works represented in the report. To thoroughly utilize the purifying material, and free the gas from all impurities, it must be slowly passed through three or more purifiers. Oxide of iron does not appear to be a favorite purifying agent with Scotch Gas Managers; only a few use it. Lime is unquestionably the best purifying agent yet discovered. Its use is, unfortunately, attended with considerable expense, and the nuisance it creates when fouled and exposed to the atmosphere are all that can be brought against it. We are to have the pleasure to-day, of examining Mr. Hislop's process for the revivification of foul lime, which has effected great saving in the cost of lime for purification at the Paisley Gas Works, and is, therefore, well worthy your inspection. Mr. Young has quite recently joined Mr. Hislop in patenting various arrangements of revivifying foul gas lime. The knowledge acquired through the present process, combined with the well-known ability and ingenuity of the patentees, has produced improvements whereby the cost of labor will be reduced to little, if anything, over half the cost the present system entails, and which, as I have already stated, effects "great saving." This improved apparatus of Messrs. Hislop and Young consist of a rotating cylinder of iron, lined with fire-bricks. The furnace for effecting the calcination of the lime is placed at one end, and the liberated gaseous impurities are drawn off at the other into a flue leading to the chimney stalk. The cylinder is slightly inclined to the furnace end, which causes the foul lime, which is charged at the higher end, to travel slowly the length of the cylinder. The rotary motion has a further advantag of burning the lime, and continuously exposing fresh surfaces to the action of the heated products of combustion from the furnace, which very much facillitates the liberation of the gaseous impurities. This will, in my opinion, almost dispense with manual labor, and secure great certainty of action. Any process that will revivify our waste lime at a small cost will be an immense saving to gas companies, until that time when liquids will supersede lime for gas purification.

You will be pleased to see from the programme that Mr. D. M. Nelson is to favor us with a paper on "Steel's Improved Apparatus for Purifying Condensing Gas." I am not acquainted with this patented process, but I know, when Mr. Nelson undertook to bring it before you, that it will possess good points, and be the means of provoking an instructive discussion.

PRESSURE ON MAINS.

The day and night pressures suggest the great saving effected by governors. There is, I believe, no instrument connected with our industry for which more patents have been granted than the governor. I have found from experience, Peeble's Patent Safety Governor to be a most reliable regulator of the pressure, and to possess, in its ingenious construction, the minimum of risks in regard to accidents. Foulis's Patent Governor, which is exhibited here to-day by the sole manufacturers, Messrs. W. and B. Cowan, is now in successful operation, both as a station and district governor, and found to be a most efficient instrument in either position. It possesses, like the governor already mentioned, advantages over its many predecessors with unprotected holders, in not being liable to pulsate, and in being proof against escapes of gas, that prove so disastrous to many works. A few months ago, Mr. Foulis invented a lamplighter and extinguisher, which was found, by experiments made in Glasgow on lamps 300 feet apart, to act not only as an efficient lamplighter and extinguisher, but also to perform the important duty of a street-lamp regulator. In this invention Foulis's patent governor plays the leading part. Mr. Scott will have the honor—through Mr. Foulis's kindness—of showing you the clever invention at work. For further information regarding it, I would refer you to the JOURNAL OF GAS LIGHTING, where a description of it will shortly appear. This mechanical lamplighter, etc., overcomes a great difficulty in being competent to light, extinguish, and regulate the consumption of gas in many street lamps from a central position. I understand Mr. Foulis is not sanguine of great profits being made through its adoption. It settles the question, however, Can it be done? But I fear until the mechanical lamplighters, etc., can clean the lamp globes, and so dispense with the present lamplighters altogether, that their advantage will be trifling. Allow me, while on this subject, to remark that I believe the streets of London will be lighted by the electric light before electricity will light and extinguish gas street lamps economically. Mr. Foulis lately added another to his numerous list of inventions—a street lamp governor. The beauty of this instrument is that the pressure, or rate per hour, can be regulated by adjusting a ball, screwed on a small lever, without taking the governor to pieces.

LEAKAGE, OR GAS UNACCOUNTED FOR.

I find, from the returns made under this head, that the leakage was as low in one works as six per cent., and as high in another as 28 per cent. There are many points in our system to which this loss can be traced. I would recommend all who have not a thermometer fixed in the inlet of the station meter to get one, and should your condensing power be deficient, you will find a considerable proportion of the unaccounted for gas due to its being registered at a higher temperature than what it was afterwards sold at. Main-pipe joints, connections, and old service-pipes contribute much to this loss, but certainly not more than old wet and dry meters. I find the ordinary wet meter, when watered four times a year, more profitable than the majority of dry ones. Mr. Dalziel, of Kilmarnock, is to honor us with a paper on "Non-Tilting Meters." This subject has long been a study of Mr. Dalziel's, and is one of great importance to all interested in the reduction of unaccounted-for gas.

ILLUMINATING POWER.

The illuminating power of the gas manufactured north of the Tweed varies from 24 to 33 standard candles. We must keep pace with the spirit of the age, and continue improving our artificial light, which the customs and amusements of society have rendered indispensable. The standard in England is year after year improving; and whenever the London companies get over the sulphur difficulty, the public cry will doubtless be for higher illuminating power, and the companies will, in all likelihood, comply with the demand, as they have ever done in the past. We cannot consider our process of gas manufacture complete until we can diffuse permanently through the gas all the naphtha vapors that are produced during the carbonization of the coal.

Mr. Young's lecture on "Carburetting Gas" will doubtless enlighten us all on a process that may soon be required either to raise or maintain our high standard of illuminating power.

Refore closing my remarks, I wish to draw your attention to the benefits secured by receiving deposits from all consumers—say, equal to four months winter consumption. A satisfactory feeling can never exist between consumers and gas companies or corporations while the latter charge deposits from one section of the community, and allow the other—considered respectable—to go without them. I consider it unfair to continue the present system. It is wrong to make respect of persons, without there is sufficient cause. The test of a man's respectability or honety, in the system generally adopted, is the number of apartments in the house he occupies. We all know that this is a most unsatisfactory test: for our experience teaches us that honest men live in the humble, as well as the higher walks of life. From the ranks of consumers—considered respectable—without deposits, the bulk of bad debts accumulate; therefore, the consumers with deposits are discontented, and justly so, because they have to pay a proportion of those bad debts in being charged more for gas than they ought to be if all were placed on the same footing as regards deposits. Four, or even five per cent. should be allowed on all deposits lodged for upwards of a year, and the interest paid, say, every three years after the deposit was lodged. By receiving deposits from all consumers they become shareholders in the undertaking, the bad debts are reduced to a mere trifle, and the time and trouble collectors have in hunting up defaulting customers are greatly reduced. As an instance of how bad debts are got rid of, I may say that a corporation adopted the system of charging deposits from all consumers a few years ago, and they, for the nine months ending February, 1878, have now less than 2s. per £100 of bad debts.

Seeing we have a long and interesting programme to discuss, I will not detain you longer than to thank you for the patient hearing given me, and ask you to freely express your opinions on the subjects brought before the meeting for discussion.

On the motion of Mr. BLACK (Alexandria) a hearty vote of thanks was accorded to the President for his interesting address.

Mr. H. AITKEN (Darroch) read the following paper:

ON THE INFLUENCES OF AQUEOUS AND OTHER VAPORS ON ILLUMINATING GAS.

Feeling a want of information upon certain points that arose in the working of what is known as the Aitken and Young process of gas making, and being unable to obtain it, I have had during the last few years the following series of experiments made to determine the influences of the following substances in 25 to 27 candle gas, viz., benzole, atmospheric air, and aqueous vapors.

1. To determine the influence of benzole in the gas, I passed the gas over benzole of commerce contained in a tube, and the following are the results:

	Gas before coming in contact with the Benzole.	Gas after having passed over Benzole.	Gain.	Grs. of Benzole by Weight to the Cub. Foot of Gas.	Grs. of Benzole per Candle of Increase.
	C'dls.	C'dls	C'dls.		
First Trial. Benzole of Commerce.	25	29·6	4·6	13·85	3
Second Trial. Benzole of Commerce.	27	31·62	4·62	13·87	3

Thus two gallons of benzole increase the illuminating power of 10,000 cubic feet of gas four candles.

	Gas before coming in contact with the Naphtha.	Gas after having passed over Naphtha.	Gain.	Grains of Naphtha per Candle of Increase.
	C'dls.	C'dls.	C'dls.	
Third Trial. Light naphthas...	28·1	29·76	1·66	2·4

Thus 1·6 gallons of naphtha increases the illuminating power of 10 000 cubic feet of gas four candles.

In this last experiment the gas was pacsed over the crude naphtha, also enclosed in a tube. In all the trials the gas was passed over the benzole or naphthas immediately before going to the burner.

In making these experiments, a small amount of white matter was precipitated into the benzole that remained, but the quantity was too small to determine its character.

No doubt the influence of benzole or naphthas on gas of, say 15 candles would be more marked; but not having this gas at cammaud, no experiment could be made.

The great increase in the illuminating power got by using crude naphthas, compared with that got from the benzole of commerce, proves that the gas not only absorbs the benzoles from the naphthas, but also a considerable quantity of the heavier hydrocarbons, and that these have a greater illuminating power than pure benzole.

The practical lesson to be drawn from these experiments is that the tars, as presently condensed, contain not only benzole, which, when properly condensed, should pass away with the gas, but also other hydrocarbons, even more valuable as illuminants, and also that when cold these heavier hydrocarbons can be taken up from the gas. This accounts, to some extent, for the high results got in working the Aitken and Young process. The general idea was that the only illuminants taken by the process from the tars were the benzoles.

2. To determine the influence of atmospheric air I made experiments with the following results:

GAS BEFORE BEING CHARGED WITH AIR, 27·82 CANDLES.

			Loss.	Loss pr ct.
Gas with	½ p. ct. air added,	27·15 candles	·67	2.41
"	1 " "	26·59 "	1·23	4·42
"	5 " "	23·73 "	4·09	14·70
"	10 " "	20·80 "	7·02	25·23

As the quantity of air added diminishes the gas burned (the gas and air were mixed before passing through the meter), it is necessary to correct this table, so as to show the loss resulting from the quantity of gas, and not the mixtures actually consumed. The following table shows this:

With ½ p. ct. air 27·15 candles + 1-199 ·14 = 27·29 candles; loss ·53: loss per cent. 1·90.

With 1 p. ct. air 26·99 candles + 4-99 ·27 = 26·86 candles; loss ·96; loss per cent. 3·45.

With 5 p. ct. air 23·73 candles + 1-19 1·25 = 24·98 candles; loss 2·84; loss per cent. 10·21.

With 10 p. c. air 20.80 candles + 1-9 2·31 = 23·11 candles; loss 4·71; loss per cent. 16·93.

These results show that the influence of a mixture of air in 27 candle gas is not so detrimental as one would have supposed. It is also to be noted that the deterioration does not proceed in equal ratio with the quantity of air added, a result I certainly was not prepared for.

3. To determine the influence of aqueous vapors the following experiments were made. The gas was dried by being passed through a tube containing fragments of anhydrous chloride of calcium.

The gas before being dried was 27·24 candles, and when dried 27·46, an increase of ·22 candle. The gas was measured before being dried, and no doubt was completely saturated with aqueous vapor, both from the holder, the meter, and the governor.

The temperature of the water in these was 59° F., which gives a tension of aqueous vapor (when saturated) of 13 millimeters out of a total 760 millimeters of the barometer. This is 4·7 per cent by weight, or almost 2·8 per cent. per volume. By drying, therefore, there is a loss of 2·8 per cent. in the volume of the gas, and a gain of 5 per cent. in the illuminating power. This is not a gain worth fighting for *per se*, but the advantage of drying gas will be further alluded to. No doubt the advantage of drying poor gases will be very much more marked than rich, but I have had no opportunity of testing them. Of course you are aware that the power of gas to absorb and retain aqueous vapors increases in proportion to the temperature, and I incorporate here, in illustration of this, a table from "Dr. Clark's Manual of Rules, Tables and Data for Mechanical Engineers," showing the quantities of aqueous vapors contained in air at different temperatures.

Properties of Saturated Mixtures of Air and Aqueous Vapor under a Constant Pressure of One Atmosphere, or 14·7 Lbs. per Square Inch, at Temperatures of from 32 deg. to 212 deg. Fahr.

Final Temperature of the Saturated Mixture or Dew-point.	Total Pressure per Square Inch.		Weight of 100 Cubic Feet.			Quantity of Heat in 100 cu. ft. reckoned from 32° Fahr. (Water at 32° for Vapor.)			Quantity of Heat in One Pound of Vapor reckoned from Water at 32° Fahr.	Quantity of Dry Air required for one pound of Vapor in Saturated Mixture.		Required initial Temperature of the Dry Air to Evaporate One Pound of Moisture in Saturated Mixture.
	Vapor.	Air.	Vapor.	Air.	Saturated Mixture.	Vapor.	Air.	Saturated Miqture.		Weight.	Volume at 62° F.	
Fahr.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Units.	Units.	Units.	Units.	Lbs.	Cub. Feet.	Fahr.
32 degs.	·089	14·611	.031	8·023	8·054	33·8	0·0	33·8	1091·2	258·8	3401	49·7
35 "	·100	14·600	·034	7·970	8·004	37·1	5·7	42·8	1092·1	234·4	3080	54·6
40 "	·122	14·578	·041	7·879	7·920	44·8	15·0	59·8	1093·6	192·2	2526	63·8
45 "	.147	14·553	·049	7·785	7·834	53·6	24·1	77·7	1095·1	158·9	2088	74·0
50 "	·178	14·522	·059	7·693	7·752	64.7	32·9	97·6	1096·6	130·4	1714	85·4
55 "	·214	14·486	·070	7·598	7·668	76.8	41·5	118·3	1098·2	108·5	1426	97·6
60 "	·254	14·446	·082	7·507	7·589	90·1	50·0	140·1	1099·7	91·6	1203	110·5
65 "	·304	14·396	·097	7·410	7·507	106·8	58·1	164·9	1101·2	76·4	1004	125·6
70 "	·360	14·340	·114	7·311	7·425	125·6	64·1	189·7	1102·8	66·0	868	140
75 "	·427	14·273	·134	7·208	7·342	147·9	73·7	221·6	1104·3	55·0	723	160
80 "	·503	14·197	·156	7·106	7·262	172·5	81·1	253·6	1105·8	45·6	599	182
85 "	·592	14·108	·182	6·996	7·178	201·6	88·1	289·7	1107·3	38·4	505	206
90 "	·693	14·007	·212	6·896	7·108	235·1	95·1	330·2	1108·9	32·5	427	233
95 "	·809	13·891	·245	6·764	7·009	272·1	101·3	373·4	1110·4	27·6	363	264
100 "	·942	13·758	·283	6·641	6·924	314·7	107·3	422·0	1111·9	23·5	308	299
105 "	1·095	13·605	·325	6·505	6,830	361 8	112·9	474·7	1113·4	20·0	263	344
110 "	1·267	13·433	·373	6·368	6·741	415·8	118·1	533·9	1115·0	17·1	224	385
115 "	1·462	13·238	·426	6·224	6·650	476·4	122·7	599·1	1116·5	14·6	192	436
120 "	1·685	13 015	·488	6·063	6·551	545·6	126·8	672·4	1118·0	12·4	163	499
125 "	1·932	12·768	·554	5·900	6·454	620·1	130·4	759·5	1119·5	10·7	140	567
130 "	2·215	12·485	·630	5·717	6·347	706·2	133·2	839·4	1121·1	9·1	118	667
135 "	2·542	12·158	·714	5·524	6·238	801·5	135·2	936·7	1122·6	7·74	102	745
140 "	2·879	11·821	·806	5·325	6·131	906·0	136·7	1042·7	1124·1	6·61	86·8	856
145 "	3·273	11·427	·909	5·106	6·015	1023·4	137·2	1160·6	1125·6	5·62	73·8	986
150 "	3·708	10·992	1·022	4·869	5 891	1151·8	136·6	1288·4	1127·2	4·77	62·6	1·145
155 "	4·193	10·507	1·145	4·619	5·764	1292·3	135·1	1427·4	1128·7	4·03	53·0	1.332
160 "	4·731	9·969	1·333	4·346	5·679	1506·5	132·2	1688·7	1130·2	3·26	42·8	1·618
165 "	5·327	9·373	1·432	4·055	5·487	1620·6	128·2	1748·8	1131·7	2·83	37·1	1·847
170 "	5·985	8·715	1·602	3·739	5·341	1815·0	122·6	1937·6	1133·3	2·33	30·7	2·212
175 "	6·708	7·992	1·774	3·402	5·176	2013·1	115·6	2128·7	1134·8	1·92	25·2	2·665
180 "	7·511	7·189	1·970	3·036	5·006	2239·0	106·8	2345·8	1136·3	1·54	20·3	3·280
185 "	8·375	6·325	2·181	2·651	4·832	2481·7	96·4	2578·1	1137·8	1·22	16·0	4·124
190 "	9·335	5·365	2·411	2·231	4·642	2747·0	83·8	2830·8	1139·4	·93	12·2	5·368
195 "	10·385	4·315	2·662	1·781	4·443	3037·0	69·0	3106·0	1140·9	·67	8·8	7·370
260 "	11·526	3·174	2·933	1·300	4·233	3350·6	51·9	3402·5	1142·4	·44	5·8	12·840
205 "	12·770	1·930	3·225	0·785	4·010	3689·5	32·3	3721·8	1143·9	·24	3·2	19·895
210 "	14·126	·574	3·543	0·232	3·775	4058·2	9·8	4068·0	1145·5	·065	·86	73·940
212 "	14·700	·000	3·683	0·000	3·683	4221·1	0·0	4221·1	1146·1	...	...	...

The power of the gas to retain naphtha is also increased by increased temperature. It would be perfectly useless to dry gas, and then pass it through a wet meter, particularly if, after that was done, the gas was subjected to a temperature below 32°. Besides, the gas would soon take up all the water in the meter.

The advantage of drying gas may not be one of very great moment in a climate like ours, and with such gas as we have; but, in countries where the temperature is very low, it is a matter of great consequence, as it enables the gas to retain larger quantities of benzole, naphthaline, and other hydrocarbons. To determine this point, I had a long series of experiments made, and found that undried gas, at a temperature of 50°, absorbed only a quarter of the quantity of benzole that dried gas did, and that when these gases were reduced to a temperature of 32°, the undried gas lost, or dropped down nearly 30 per cent. of the naphthas it had absorbed, whereas the dried gas dropped less than 12 per cent.

The naphthas used in these experiments were extracted from coal gas by means of heavy oil, and then distilled for separation, and their specific gravity ranged from ·808 to ·830. After the gas had passed over these naphthas, there was a marked increase in the specific gravity. The ·808 had risen to ·812, and the color of the naphthas was considerably darker. On the temperature of 25 to 27 candles being reduced to 32° it drops equal to 7000 grains of naphthas or benzole to 10,000 cubic feet (along with the quantity of water due to the change in temperature), and according to the foregoing experiments this means a loss of illuminating power of about a quarter of a candle.

These experiments were made by passing the gas through two jars, six inches by seven inches, the gas being let in at the top, and out through a tube from the bottom.

The jars were kept immersed in a freezing compound, and the gas brought off as nearly as possible at 32°. In this way there was a continuous current through the jars. This brings me to another important point, viz., the influence of current, or the want of it, on the dropping down point of naphthas. The experiments undertaken with the view of determining this are not yet completed, but they are sufficiently advanced to enable me to say that 25 to 27 candle gas, at a temperature of, say 40° to 50°, will in a current not only not drop down its naphthas, but will, on the contrary, lick up a considerable quantity, and hold it so long as motion continues.

One curious feature in the experiments made to determine this is the unexpected compounds that drop from the gas while in a state of rest or partial rest. At one time they are black substances like clotted blood, at another they are white, and sometimes they are partly both. The black substance sinks in water, while the white does not; but their chemical composition I have not yet determined, not having got sufficient quantity to operate on.

I think these experiments are sufficiently advanced to enable me to say that the deposition of the naphthas on the water in the gasholders may be almost, if not entirely, prevented, by placing on the top of the outlet-pipe from the gasholder a dome, or an arrangement like a flat umbrella, so that the gases, before leaving the gasholder, may go down to within a few inches of the water, and so lick up any naphthas that may have been deposited on its surface, and that the pipes to which the drip-boxes in the streets are connected should be made flat in the bottom, and that the pipe connecting the drip-boxes with them shall be placed at the very bottom, so as to allow the water to be pumped off first. In this way I expect that in most situations any naphthas that drop from the gas (so long as the temperature does not come below, say, 35°) would be carried off by the gas so soon as it got into motion; the quality of the gas remaining uniform.

The experiments I have made on the influence of steam put into gas, and therefore condensing it, show results, so far as I have gone, so conflicting that I will require to repeat them on a larger scale and with apparatus more complete.

My time being much occupied otherwise, I had to get others to perform most of the experiments, viz., Dr. Wallace of Glasgow, and Mr. M'Alley, of Falkirk. Indeed, these gentlemen performed nearly the whole of the experiments, and they therefore carry much more weight than if they had been made by myself in those short intervals we call leisure.

[To be continued.]

Gas Cooking Stoves.—It is but recently that an order from a large wholesale house in Manchester, Eng., for 1500 retort gas cooking stoves was received by the the Retort Gas Stove Co., of Providence, R.I. These stoves were tested by many English Gas Engineers, and pronounced superior to the English stoves. From the low price of gas, and the great degree of interest exhibited by the English gas companies for the introduction among their consumers of all kinds of gas apparatus, the manufacturers are expecting a large trade from that quarter.

Prof. Henry Morton—who has been appointed to the vacancy in the United States Lighthouse Board, caused by the decease of Prof. Joseph Henry, is one of our accomplished Philadelphia scientists, although he is now President of the Stevens Institute of Technology, at Hoboken, N. J. His admirable and splendidly illustrated lectures, at the Academy of Music, in this city, on scientific subjects, will recall him to the memory of our people. The Franklin Institute, of which he was the able Secretary, has no need of a reminder. He is the son of Rev. Dr. Henry J. Morton, rector of St. James' Episcopal Church. In making the selection of Prof. Morton for the Lighthouse Board vacancy, Secretary Sherman hit exactly on the man who can fill the position.—*Phila. Ledger.*

Prices of Gas Coal.

Waverly Youghiogheny	5.25	
Moore's "	5.50	
Shafton	5.35	
Despard Marion	5.15	
Newburgh Orrel	@	3.85 at Baltimore.
Murphy Run	5.25	
Chesapeake and Ohio Agency Coal	5.25	4.00 at Richmond.
Newcastle	3.75 @ 3.85	
Provincial	4.15 @ 4.50	
Cannelton Cannel	10.00	
Ince Hall	8.00	

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(with W B Scott & Co.,)

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July 2, 1878.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share. ☜

Gas. Co.'s of N. Y. City.

	Capital.	*Par.*	*Bid.*	*Asked.*
Central, Westchester	466,000	50	—	80
Harlem	$1,850,000	50	85	88
Manhattan	4,000,000	50	185	190
Metropolitan	2,500,000	100	132	135
" Scrip	$1,000,000	...	100	103
Mutual	5,000,000	100	74	78
" Bonds, gold.	900,000	1000	—	105
Municipal	1,000,000	100	95	100
New York	4,000,000	100	95	98
Suburban, W'steh'str	390,000	50	—	100
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	130	140
Citizens	1,200,000	20	70	—
" Scrip	320,000	1000	95	97½
Peoples	1,000,000	10	10	20
" Bonds	$ 325,000	...	--	95
" Scrip	300,000	...	75	80
Metropolitan	1,000,000	100	—	65
Nassau	1,000,000	25	--	78
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	75	81
" Scrip		...	95	97
Kings Co	200,000	100	80	90
Union Co. E. N. Y.		25	—	50
Richmond Co., S. I.	300,000	...	80	90
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md.	2,000,000	100	134	134
" Ctfs., gold	1,000,000		106	110
Bayonne, N. J.		100		90
Brockport, N. Y.	25,000	100	...	80
Citizens, Newark	918,000	50	109	110
Chicago Gas Co., Ills			150	
" " Bds.	124,000	—	105	107
Cincinnati G & C Co				190
Derby of Conn.	160,000	100	60	80
East Boston, Mass.		25	132	---
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind.		100	...	---
Hannibal, Mo.	100,000	100	95	100
Hartford, Conn.	700,000	25	184	186
Hempstead, L. I.	25,000	100	...	—
Jersey City	386,000	20	155	160
Jamaica, L. I.	25,000	100	...	—
Jacksonville, Ill.	120,000	50	82	...
Lewistown Maine	400,000	100	70	80
Lima, Ohio,	60,000	100	--	...
Bonds	30,000		90	
Laclede St Louis Mo.	1,200,000	100	100	110
Long Branch		20	40	50
New Haven, Conn.		25	160	—
Peoples, Jersey City		...	110	118
Peoples of Albany	650,000	100	10	17
" Bonds	350,000	1000	--	-
Peoples of Baltimore		25	51	52
" Bonds			106	—
Plainfield, N. J.	80,000	100	—	105
Perth Amboy		25	—	95
Rochester, N. Y.		100	50	60
Woonsocket, R. I.	150,000	100	95	...
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
San Francisco Gas-Co., S. Fr'isco Cal.			93	94
St. Louis, Missouri.	600,000	50	73	75
Stillwater, Minn.	50,000	50	—	26
Saugerties, N. Y.	15,000	100	95	100
Troy, Citizens	600,000	100	—	60
Toledo, Ohio			95	97
Washington, D. C.		20	230	240

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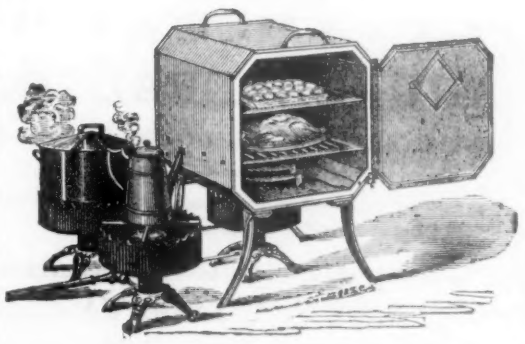

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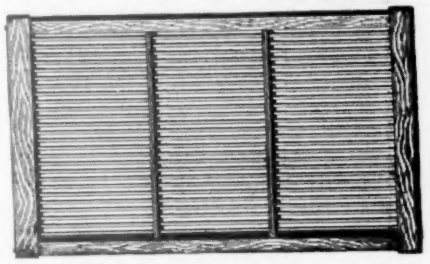

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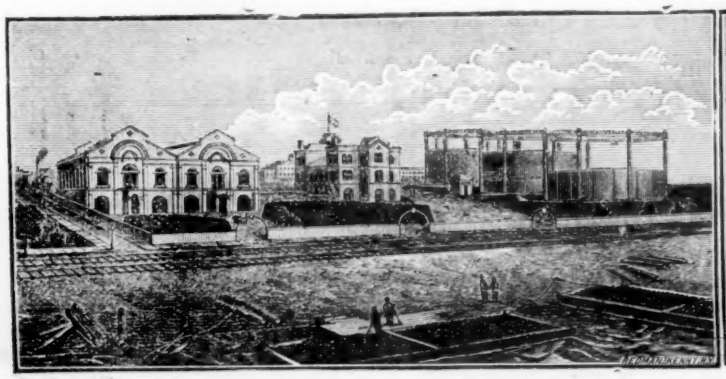

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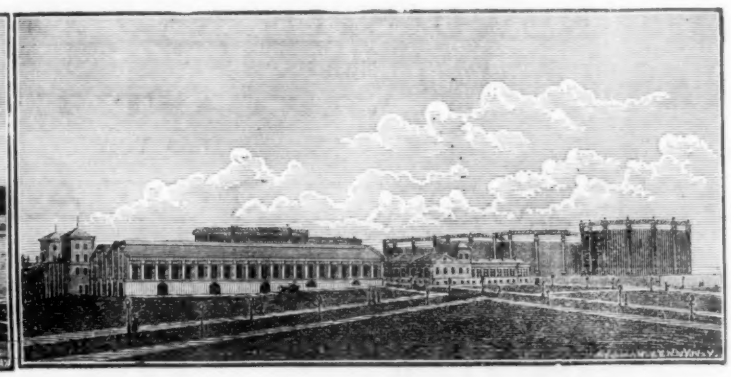

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351-1y

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Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

234-1y n

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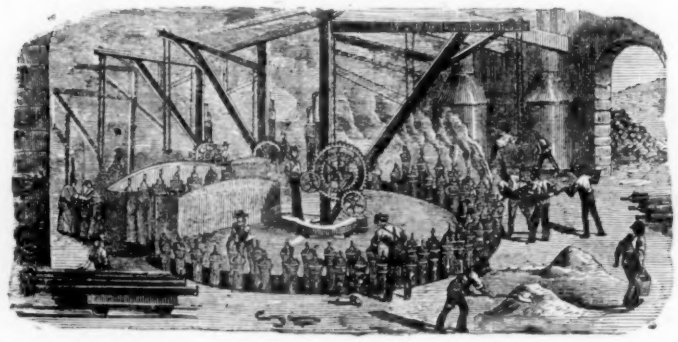

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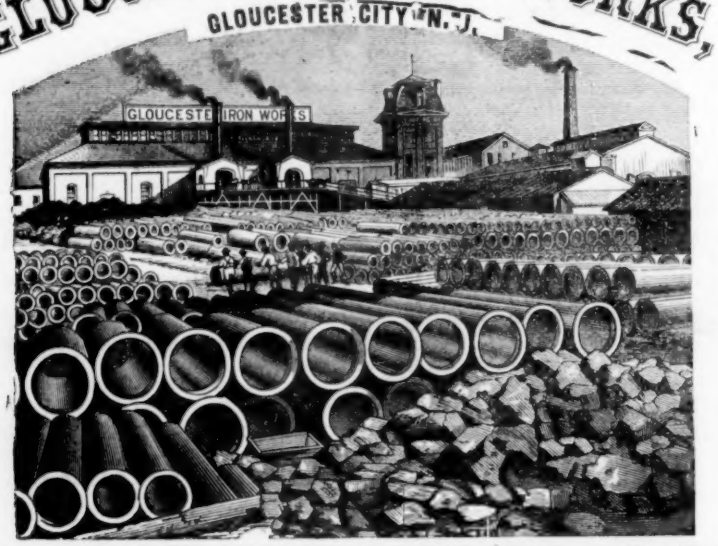

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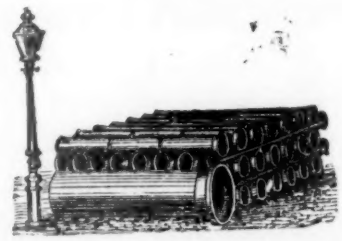

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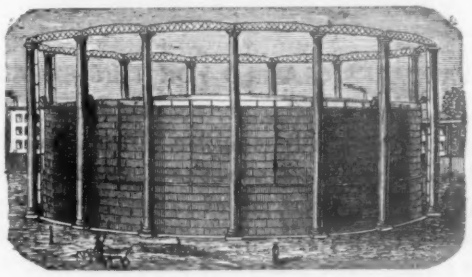

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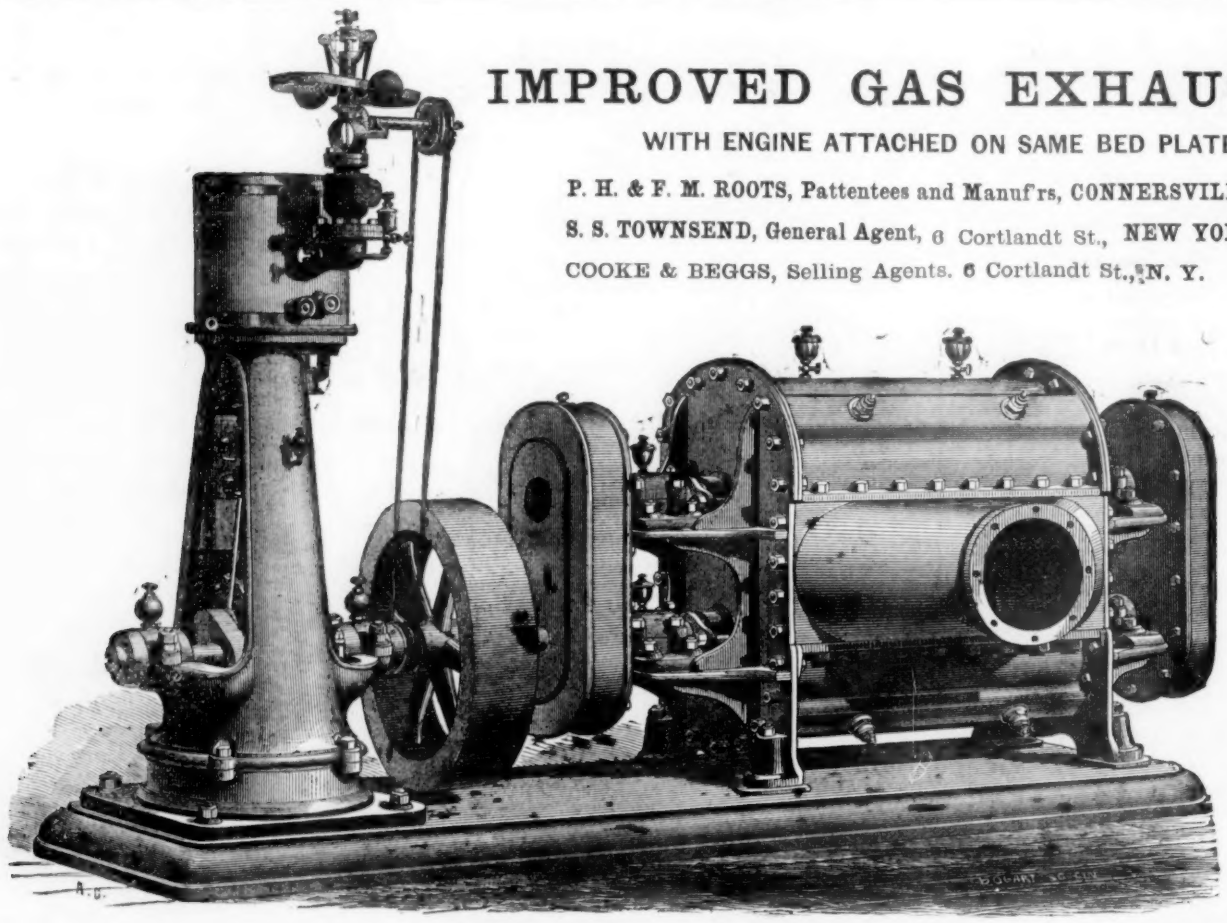

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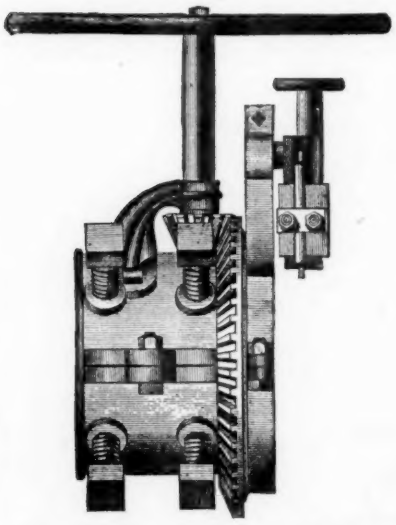

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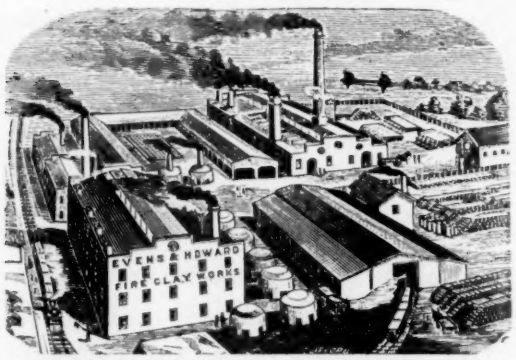

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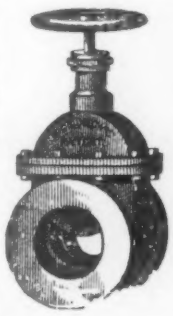

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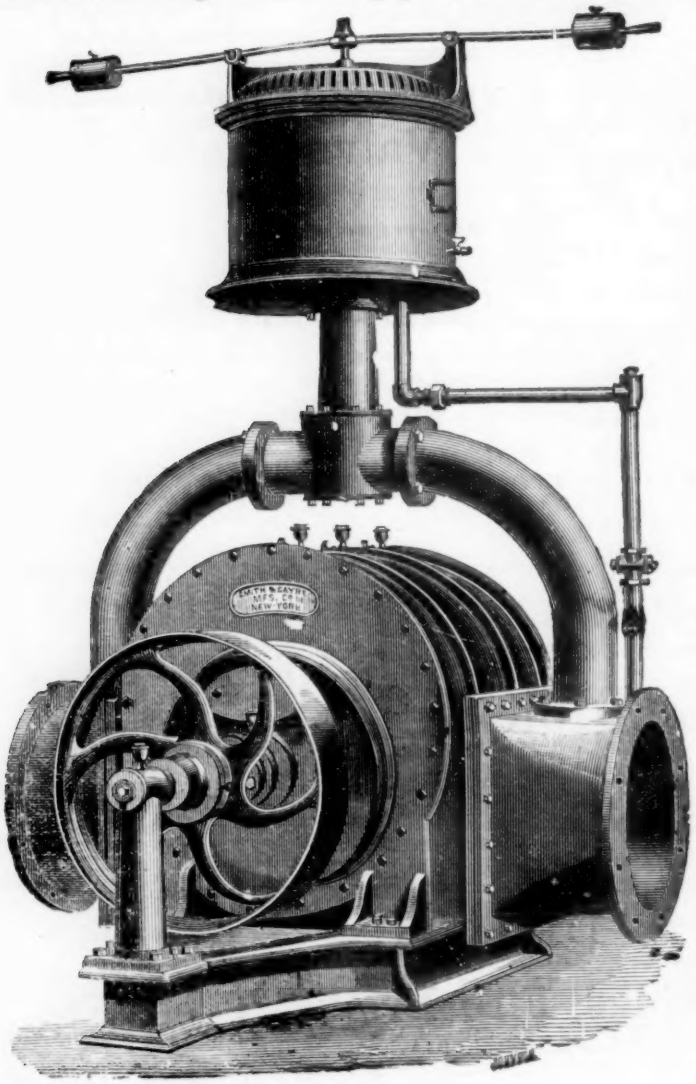

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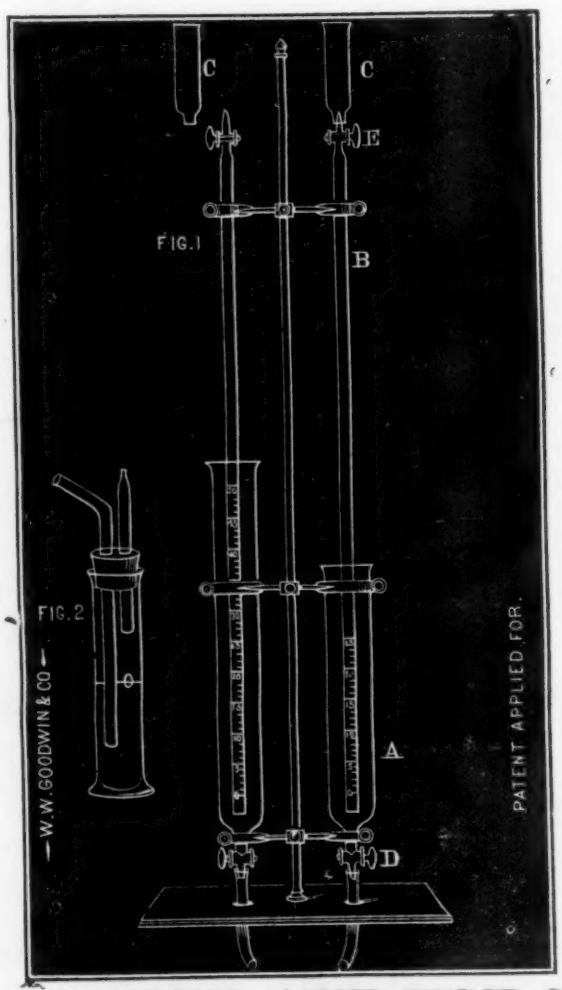

The apparatus will determine the presence of the following gases, and their quantity:

Ammonia	(NH^3)
Sulp. Hydrogen	(H^2S)
Carbonic Acid	(CO^2)
Air, Oxygen and Nitrogen.	
Bisulp. of Carb.	(CS^2)
Olefiant Gas	(C^2H^4)
Carbonic Oxide	(CO)
Light Carburetted Hydrogen	(CH^4)
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